Page 1 1 UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT AND TRIAL AND APPEAL 2 BOARD 3 -----X GOOGLE, INC., Petitioner, 4 IPR-2015-00343 IPR-2015-00345 5 IPR-2015-00347 vs. IPR-2015-00348 6 NETWORK-1 TECHNOLOGIES, 7 Patent Owner. -----x 8 Patent Nos. 8,640,179 8,205,237 9 8,010,988 10 8,056,441 -----X 11 12 VIDEOTAPED DEPOSITION OF GEORGE KARYPIS New York, New York 13 Thursday, November 12, 2015 14 9:05 a.m. 15 16 17 18 Reported by: Jennifer Ocampo-Guzman, CRR, CLR 19 20 21 22 23 24 25 Job No. CS2183243

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1	1 450 2	1	APPEARANCES (CONTINUED):
2		2	
3		3	AMSTER ROTHSTEIN & EBENSTEIN, LLP
4		4	Attorneys for Patent Owner
5		5	90 Park Avenue
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8	November 11, 2015	8	BY: CHARLES R. MACEDO, ESQ.
9	9:05 a.m.	9	cmacedo@arelaw.com
10		10	COREY HOROWITZ, ESQ.
11	Videotaped Deposition of GEORGE	11	(p.m. session)
12	KARYPIS, held at the offices of Amster	12	(1)
13	Rothstein & Ebenstein LLP, 90 Park	13	
14	Avenue, New York, New York, New York,	14	ALSO PRESENT:
15	pursuant to notice, before Jennifer	15	CHRISTOPHER HANLON, Videographer
16	Ocampo-Guzman, a Certified Real-Time	16	
17	Shorthand Reporter and Notary Public of	17	
18	the State of New York.	18	
19	the State of New Tork.	19	
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$\begin{vmatrix} 1 \\ 2 \end{vmatrix}$	THE VIDEOGRAPHER: Good morning. We are now on the record. Please note	$\begin{vmatrix} 1\\2 \end{vmatrix}$	Q. You understand you've just been sworn to testify under oath in the same
$\begin{vmatrix} 2\\ 2 \end{vmatrix}$		$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	manner you would if you were testifying in a
	that the microphones are sensitive and	4	court of law?
4	may pick up whispering and private		A. Yes.
5	conversations. Please turn off all	5	
6	cellphones or place them away from the	6	Q. And do you feel there's any reason
7	microphones, as they can interfere with	7	that you can't testify fully and accurately
8	the deposition audio. Recording will	8	today?
9	continue until all parties agree to go	9	A. No.
10	off the record.	10	Q. No medical conditions or health
11	My name is Christopher Hanlon	11	issues that would interfere with your ability
12	representing Veritext. The date today	12	to testify?
13	is November 12, 2015. The time is	13	A. No.
14	approximately 9:05 a.m. This deposition	14	Q. Have you ever given a deposition
15	is being held at Amster Rothstein &	15	before?
16	Ebenstein located at 90 Park Avenue, New	16	A. No, I have not.
17	York, New York and is being taken by	17	Q. Have you ever served as an expert
18	counsel for the petitioner.	18	witness in a litigation before?
19	The caption in this case is Google	19	A. No, I have not.
20	Incorporated versus Network-1	20	Q. Just a couple of general background
21	Technologies, being held before The	21 22	comments, then.
22	Patent Trial and Appeal Board, case	22	Jennifer will be taking down
23 24	numbers 343, 345, 347, and 348. The name of the witness today is	23	everything we say today on the record. I'm going to try, against my normal tendency, to
24	Dr. George Karypis. At this time I	24	speak slowly and clearly; but if my questions
23	DI. George Karypis. At this time i	25	speak slowly and clearly, but it my questions
	Page 7		Page 9
1	would ask counsel to please state your		are not clear to you either because you can't
2	appearances for the record.	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	hear them or can't understand them, feel free
3	MR. NEMEC: Douglas Nemec of	3	to ask me to clarify.
4	Skadden Arps for the petitioner, Google.	4	Is that fair?
5	And with me is Andrew Gish, also with	5	A. Yes.
6	Skadden Arps for the petitioner.	6	Q. And likewise so as to avoid talking
7	MR. LUNER: Sean Luner for Patent	7	over each other and making Jennifer's even
8	Owner Network-1 Technologies from Dovel	8	more difficult than it already is, I would
9	& Luner.	9	ask you to wait to answer until I've finished
10	MR. MACEDO: Charles Macedo from	10	my question; and I in turn will wait for your
11	Amster Rothstein & Ebenstein, also for	11	answer before I ask another question. Fair?
12	the Patent Owner, Network-1	12	A. Fair.
13	Technologies.	13	Q. If you would like to take a break
14	THE VIDEOGRAPHER: Thank you.	14	during the course of today's proceedings,
15	Our court reporter today is	15	feel free to speak up. I generally break
16	Jennifer Ocampo-Guzman, representing	16	every 90 minutes or so, but this is not a forced march, so if you need to stop out
17 18	Veritext. She will now swear in Dr. Kerwis and we can proceed	17 18	forced march, so if you need to step out, please speak up.
18	Dr. Karypis and we can proceed. GEORGE KARYPIS, called as a	18	A. I will.
		20	
20	witness, having been duly sworn, was examined and testified as follows:	20	Q. You understand that you are here to testify today in connection with a
21 22	EXAMINATION BY	21	testify today in connection with a declaration that you submitted on behalf of
22	MR. NEMEC:	22	declaration that you submitted on behalf of Network-1 Technologies, correct?
23		23	A. Correct.
21			
24 25	Q. Good morning, Dr. Karypis.A. Good morning.	25	Q. And that declaration was submitted

3 (Pages 6 - 9)

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1	Page 10	1	Page 12 Cox patents should be interpreted and the
1 2	in connection with four inter partes review proceedings that were instituted at the	$\begin{vmatrix} 1\\2 \end{vmatrix}$	Cox patents should be interpreted, and the second category being the teachings of the
$\frac{2}{3}$	request of Google?	$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	prior art?
	A. Yes.		A. Correct.
4		4	Q. In connection with forming your
5	Q. And there are four U.S. patents at	5	
6	issue in those IPR proceedings, right? A. Yes.	6 7	opinions, what information did you rely upon?
7 8			A. The specific information I rely
0 9	Q. And you've referred to those as the	8 9	upon I believe is listed in my declaration.
10	IPR patents in your declaration? A. I believe so.	10	I can give you the exact list, if you give me a copy of it.
11	Q. And the inventor on each of those	10	
12	patents is a man named Dr. Cox, correct?	11	But on top of my head, it involves what you referred to as the Cox patents, the
12	A. Correct.	12	the patents that was submitted by Google
13	Q. So if I occasionally refer to the	13	as part of the IPR, specifically the Ghias
15	patents today as the Cox patents, will you	14	patent, the Iwamura patent, Conwell patent,
16	understand what I'm talking about?	15	the Dr. Moulin's declaration and deposition
17	A. Yes.	17	and the IPR filings that Google filed.
18	Q. Just a couple of other terminology	18	Q. The last item, I'm sorry, was the
19	points before we move on. I may refer to the	10	actual filings?
20	board or the P tab.	20	A. Correct.
20	Are those terms that you've heard?	20	Q. So the petitions?
22	A. Yes, I have.	$\frac{21}{22}$	And were there also some Wikipedia
23	Q. The P tab is the Patent Trial and	22	pages to which you referred?
23	Appeal Board. You understand that that's the	24	A. Correct. I believe there were two
25	tribunal that will be, in the first instance,	25	or three Wikipedia pages. Everything is
			of three () hilpedia pages. Everything is
1	Page 11	1	Page 13
1	deciding the matters in dispute in this case?	1	fully detailed in my declaration.
2	deciding the matters in dispute in this case? A. Yes.	2	fully detailed in my declaration.Q. Okay. Let me focus for a moment on
2 3	deciding the matters in dispute in this case?A. Yes.Q. Okay. In the declaration that you	2 3	fully detailed in my declaration.Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of
2 3 4	deciding the matters in dispute in this case?A. Yes.Q. Okay. In the declaration that you submitted on behalf of Network-1, you	2 3 4	fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin
2 3 4 5	deciding the matters in dispute in this case?A. Yes.Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions,	2 3 4 5	fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that
2 3 4 5 6	deciding the matters in dispute in this case?A. Yes.Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions, correct?	2 3 4 5 6	fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that right?
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2 3 4 5 6 7 8 9	 deciding the matters in dispute in this case? A. Yes. Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions, correct? A. Correct. Q. And you expressed the opinion that the challenged claims of the Cox patents are 	2 3 4 5 6 7 8 9	 fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that right? A. Correct. Q. In what fashion, generally speaking, did you rely upon Dr. Moulin's
2 3 4 5 6 7 8 9 10	 deciding the matters in dispute in this case? A. Yes. Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions, correct? A. Correct. Q. And you expressed the opinion that the challenged claims of the Cox patents are not unpatentable, correct? 	2 3 4 5 6 7 8 9 10	 fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that right? A. Correct. Q. In what fashion, generally speaking, did you rely upon Dr. Moulin's declarations in forming your opinions?
2 3 4 5 6 7 8 9 10 11	 deciding the matters in dispute in this case? A. Yes. Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions, correct? A. Correct. Q. And you expressed the opinion that the challenged claims of the Cox patents are not unpatentable, correct? A. Correct. A. Correct. 	2 3 4 5 6 7 8 9 10 11	 fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that right? A. Correct. Q. In what fashion, generally speaking, did you rely upon Dr. Moulin's declarations in forming your opinions? A. I read the declarations. I just
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2 3 4 5 6 7 8 9 10 11 12 13	 deciding the matters in dispute in this case? A. Yes. Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions, correct? A. Correct. Q. And you expressed the opinion that the challenged claims of the Cox patents are not unpatentable, correct? A. Correct. Q. You've expressed the opinion that the challenged claims of the Cox patents are not unpatentable, correct? 	2 3 4 5 6 7 8 9 10 11 12 13	 fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that right? A. Correct. Q. In what fashion, generally speaking, did you rely upon Dr. Moulin's declarations in forming your opinions? A. I read the declarations. I just tried to understand some of the context, you know, behind the IPR filings, and that's
2 3 4 5 6 7 8 9 10 11 12 13 14	 deciding the matters in dispute in this case? A. Yes. Q. Okay. In the declaration that you submitted on behalf of Network-1, you expressed certain technical expert opinions, correct? A. Correct. Q. And you expressed the opinion that the challenged claims of the Cox patents are not unpatentable, correct? A. Correct. Q. You've expressed the opinion that the challenged claims of the Cox patents are not unpatentable, correct? 	2 3 4 5 6 7 8 9 10 11 12 13 14	 fully detailed in my declaration. Q. Okay. Let me focus for a moment on the Moulin declaration. That's a set of declarations submitted by Dr. Pierre Moulin in support of Google's petitions; is that right? A. Correct. Q. In what fashion, generally speaking, did you rely upon Dr. Moulin's declarations in forming your opinions? A. I read the declarations. I just tried to understand some of the context, you know, behind the IPR filings, and that's about it.
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4 (Pages 10 - 13)

		J P15	
	Page 14		Page 16
1	Just, you know, fed them.	1	Q. Do you consider yourself to be an
2	Q. So once again, with respect to the	2	expert on patent law?
3	deposition, would it be fair to say that you	3	A. No.
4	relied upon it for contextual purposes?	4	Q. Do you consider yourself to be an
5	A. There are a few places my	5	expert on patent office procedures?
6	declaration which I specifically, you know,	6	A. No.
7	point to certain aspects of documents,	7	Q. So you wouldn't be qualified to
8	declarations, to confirm, you know, some of	8	offer expert opinions on legal issues, then;
9	my beliefs. And I think, you know, to a	9	is that fair to say?
0	large extent that's about it, so.	10	A. I think that's a fair statement.
1	Q. Okay. So for example, in instances	11	Q. For example, independent of
2	where you agreed with what Dr. Moulin had	12	information that may have been conveyed to
3	testified, you might point to his deposition	13	you by counsel, you have no expertise on wha
4	for that purpose, right?	14	the various burdens of proof are in an inter
5	A. That would be correct.	15	partes review petition, correct?
16	Q. If you didn't have Dr. Moulin's	16	A. That is correct.
17	deposition testimony, do you think your	17	Q. And you have no independent
18	opinions in this case would be any different?	18	knowledge of the legal standards for
19	A. I do not think so.	19	determining anticipation of a patent claim,
20	Q. And you indicated that you had also	20	correct?
21	relied upon the actual filings, the IPR	21	A. Not prior to
22	petitions.	22	(Discussion off the record.)
23	In what fashion did you rely upon	23	A. Not prior to
24	those materials?	24	(Discussion off the record.)
25	A. I just looked at, you know, the	25	A. Not prior, I said, the answer to
	· ·		
1	Page 15	1	Page 17 that is yes.
1	claim constructions I believe that's what you		
	call it that the IDD natitions you know		•
2	call it, that the IPR petitions, you know,	2	MR. MACEDO: "Not prior to talking
3	put forth and how alleged the claims of the	2 3	MR. MACEDO: "Not prior to talking to the counsel, yes."
3 4	put forth and how alleged the claims of the Cox patents are anticipated by the prior art.	2 3 4	MR. MACEDO: "Not prior to talking to the counsel, yes." (Discussion off the record.)
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	Page 18		Page 20
1	Cox patents, correct?	1	to develop any kind of system to identify
2	A. By "disclosure," you mean	2	records in a database that are similar or
3	specification?	3	very similar to a particular query?
4	Q. That's a good point, so another	4	A. My recollection from the
5	terminology issue: If I refer to the	5	specification is that the answer to that is
6	specification of prior art or the Cox	6	no. The specification I believe discloses a
7	patents, I'm referring to the text that	7	bunch of methods to solve the problem.
8	precedes the claims in the patents.	8	Q. And generally speaking what is it
9	Is that consistent with your	9	that distinguishes the method for identifying
10	understanding?	10	or system for identifying records that Dr.
11	A. Yes.	11	Cox purports to have invented from those that
12	Q. Okay. So have you excuse me	12	came before?
13	have you studied the specification in the Cox	13	MR. LUNER: Can you repeat the
14	patents in connection with your work on this	14	question?
15	case?	15	MR. NEMEC: Sure. You want it just
16	A. Yes, I have.	16	read back. Why don't you go ahead and
17	Q. How would you characterize the	17	read back.
18	field of the Cox invention?	18	(A portion of the record was read.)
19	A. So the general field of the Cox	19	MR. LUNER: Objection to form.
20	invention falls in the general area of, I	20	A. So this is a very broad question.
21	would say information retrieval and from a	21	So, and I believe in my declaration I kind
22	technical point, and, you know, that's about	22	of, you know, tried to summarize what are the
23	it.	23	key distinguishing features of the invention
24	Q. Do you think content recognition	24	that is disclosed.
25	would be an accurate characterization of the	25	Now going, I can read you that
		20	
1	Page 19 field of the Cox patents?	1	Page 21 section, but off the top of my head there are
		-	
2	A No content recognition content	2	
23	A. No content recognition, content retrieval yeah those would be you know	23	a bunch of different components. One has to
3	retrieval, yeah, those would be, you know,	3	a bunch of different components. One has to do with a nonlinear search. The other one
3 4	retrieval, yeah, those would be, you know, the fields.	3 4	a bunch of different components. One has to do with a nonlinear search. The other one has to do with a non-exhaustive search.
3 4 5	retrieval, yeah, those would be, you know, the fields. Q. And based on your review of the Cox	3 4 5	a bunch of different components. One has to do with a nonlinear search. The other one has to do with a non-exhaustive search. Another one has to do with a near neighbor
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6 (Pages 18 - 21)

1	Page 22	1	Page 24
$\begin{vmatrix} 1 \\ 2 \end{vmatrix}$	Q. Is it your understanding from the	1 2	A. I cannot find the exact place, but
2 3	disclosure in the Cox patents that Dr. Cox found it undesirable to find an exact match?	2 3	repeat your question and I can answer it from my head.
4		3 4	•
	A. I don't recall if it was explicitly stated it's undesirable or not, but yeah,	4 5	Q. Sure. So the question that I had posed was, what is your understanding of the
5	-		
6 7	actually I don't recall if it's saying it's undesirable to find an exact match.	6	term "nonlinear," separate and apart from the Cox patents?
8		7 8	A. Sure. So the term "nonlinear," you
8 9	Q. A moment ago you used the term "nonlinear," I believe.	8 9	know, first, you usually do, you know, I have
10	Do you mean that to be synonymous	10	a function that is a parameter of a certain
11	with sublinear?	10	variable, let's say N. Like if I increase
12	A. Well, nonlinear is not synonymous	12	that variable by certain fraction, like, so I
12	with sublinear, but in the context of the Cox	12	look at 2N or 4N; if I have an increase in
13	patents the nonlinearity that they're talking	13	the amount of the value of that function,
15	about is sublinearity.	14	right, that is not the same proportion,
16	Q. So you mean in general nonlinearity	16	right. It's not 2, a factor of 2 or a factor
17	is not synonymous with sublinearity, separate	17	of 4. If I have the corresponding increase
18	from the Cox patents?	18	on the integer variable, but then that would
19	A. Yes.	19	be a nonlinear function.
20	Q. What, then separate from the Cox	20	Q. How does the definition that you
21	patents, what do you understand nonlinearity	21	just gave differ from the definition of
22	to mean?	22	sublinear, as you understand it, separate
23	A. Something that is not linear. I	23	from the Cox patents?
24	believe I have a precise definition of	24	A. I think it is exactly the same
25	linearity in my disclosure, but, you know, a	25	definition. The notion of sublinear is a
1	Page 23 function, you know, of, you know, that	1	Page 25 function in which you find increase by let's
2	increases at a rate that is either higher,	2	say a factor of 2 or a factor of 4, right, an
3	greater or smaller than linear is a nonlinear	3	increase in the output of that function would
4	function. For example, a function that is	4	be less than a factor of 2 or a factor of 4.
5	quadratic would be a nonlinear function.	5	Q. Now, in your view is the term
		-	
	-	6	- •
6	Q. By "rate," do you mean to imply	6 7	"sublinear" used differently in the Cox
6 7	Q. By "rate," do you mean to imply speed?	7	"sublinear" used differently in the Cox patents?
6 7 8	Q. By "rate," do you mean to imply speed?A. So this is very precisely described	7 8	"sublinear" used differently in the Cox patents? A. No, I believe this is the use of,
6 7 8 9	Q. By "rate," do you mean to imply speed?A. So this is very precisely described in my declaration. I can give you the	7 8 9	"sublinear" used differently in the Cox patents? A. No, I believe this is the use of, this is how the term is used.
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6 7 8 9 10 11	 Q. By "rate," do you mean to imply speed? A. So this is very precisely described in my declaration. I can give you the definition. Actually, can you give me a copy of the declaration? 	7 8 9 10 11	"sublinear" used differently in the Cox patents?A. No, I believe this is the use of, this is how the term is used.Q. You mentioned the term"non-exhaustive" a new moments ago as well,
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6 7 8 9 10 11 12 13 14 15 16 17 18 19	 Q. By "rate," do you mean to imply speed? A. So this is very precisely described in my declaration. I can give you the definition. Actually, can you give me a copy of the declaration? MR. NEMEC: Sure. We can go ahead and mark it. We will mark as Karypis 1 the declaration of Dr. George Karypis submitted in the four IPR proceedings. (Karypis Exhibit 1, Declaration of George Karypis, marked for identification, this date.) 	7 8 9 10 11 12 13 14 15 16 17 18 19	 "sublinear" used differently in the Cox patents? A. No, I believe this is the use of, this is how the term is used. Q. You mentioned the term "non-exhaustive" a new moments ago as well, correct? A. That's correct. Q. Non-exhaustive is one of the terms that appears in the claims of the Cox patents, right? A. I believe so. Q. The actual term "non-exhaustive" is not used in the specification of the Cox
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6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 Q. By "rate," do you mean to imply speed? A. So this is very precisely described in my declaration. I can give you the definition. Actually, can you give me a copy of the declaration? MR. NEMEC: Sure. We can go ahead and mark it. We will mark as Karypis 1 the declaration of Dr. George Karypis submitted in the four IPR proceedings. (Karypis Exhibit 1, Declaration of George Karypis, marked for identification, this date.) (Discussion off the record.) THE WITNESS: At some point in time we'll switch to iPad with those? 	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 "sublinear" used differently in the Cox patents? A. No, I believe this is the use of, this is how the term is used. Q. You mentioned the term "non-exhaustive" a new moments ago as well, correct? A. That's correct. Q. Non-exhaustive is one of the terms that appears in the claims of the Cox patents, right? A. I believe so. Q. The actual term "non-exhaustive" is not used in the specification of the Cox patents, though, right? A. I don't recall. Q. Dr. Cox, in his disclosure in his

Karypis

	TXu	ypis	
	Page 26		Page 28
1	Q. You believe he does purport to have	1	point, then you disregard the first half of
2	invented it?	2	the array, and you perform the same search on
3	A. He does not.	3	the second part of the array.
4	Q. He does not. So as of 2000, when	4	You continue that way until you
5	Dr. Cox' patent applications were filed,	5	either find that value in the array, or your
6	non-exhaustive searching was a concept known	6	end result becomes an array, at which point
7	in the art, correct?	7	in time you don't find the value.
8	A. Correct.	8	Q. Now, if the array you are seeking
9	Q. As of 2000, had you had exposure to	9	to search is not sorted, can you still
10	the concept of non-exhaustive searching in	10	perform a binary search on that array?
11	your work?	11	A. You can perform a binary search,
12	A. I believe you mean prior to 2000.	12	not and get a correct result. But if your
13	Q. In or prior to, sure.	13	goal is to get the correct answer, you cannot
14	A. Yes.	14	perform binary search.
15	Q. In what context?	15	Q. And what do you mean by "the
16	A. For example, a fairly widely-used	16	correct result"?
17	algorithm to research a site array is to do a	17	A. In the example that I gave, if the
18	binary search. That would be an example of a	18	number exists in the array, then it will
19	non-exhaustive search.	19	return true. If the number does not, it will
20	Q. And you've personally worked with	20	return false. If the array is not sorted,
20		20	there are no guarantees that the algorithm
	such algorithms in or before 2000?	21	<u> </u>
22	A. Yes.		will explain, will lead to the correct
23	Q. Do you recall other instances in	23	answer.
24	which you had firsthand experience with	24	Q. So it might return the correct
25	non-exhaustive searching in or before 2000?	25	answer, but it also might not?
	Page 27		Page 29
1	A. Another approach by 2000 used for	1	A. A high probability it will not.
2	non-exhaustive search would be hash tables.	2	Q. Can you use a binary search to find
3	Q. Any other examples that you can	3	a near match or only an exact match?
4	recall of	4	A. The standard binary search on the
5	MR. NEMEC: Excuse me, I'll start	5	sorted array can be modified to find a near
6	that over.	6	match.
7	Q. Any other examples you can recall	7	Q. What sort of modification would be
8	of non-exhaustive search techniques that you	8	required?
9	worked with in or before 2000?	9	A. There are a couple of ways to
10	A. Not that I can recall finding	10	implement it, but I would presume a standard
11	techniques that I have worked with.	11	way of doing that is after you do your binary
12	Q. You mentioned binary search.	12	search and you get an Mk array, then, you
13	A binary search is a non-exhaustive	13	know, conceptually you backtrack to your
14	search; is that correct?	14	previous step and, you know, that middle
15	A. That is correct.	15	value on your previous step can be returned
16	Q. Can you explain to me briefly how a	16	plus a, you know, near match.
17	binary search works?	17	Q. You also mentioned hash tables.
18	A. So assume you have an array of	18	Was the use of hash tables a form
10		10	or non-exhausive searching /
19 20	let's assume numbers and solving in	19 20	of non-exhaustive searching?
20	let's assume numbers and solving in increasing order, and the search is trying to	20	A. Yes.
20 21	let's assume numbers and solving in increasing order, and the search is trying to answer the question, is a number in the array	20 21	A. Yes.Q. Can you explain how a hash table
20 21 22	let's assume numbers and solving in increasing order, and the search is trying to answer the question, is a number in the array or not. And, you know, what do you is you	20 21 22	A. Yes.Q. Can you explain how a hash table works? In general terms.
20 21 22 23	let's assume numbers and solving in increasing order, and the search is trying to answer the question, is a number in the array or not. And, you know, what do you is you check the middle point therein and compare it	20 21 22 23	A. Yes.Q. Can you explain how a hash table works? In general terms.A. So the two prototypical types of
20 21 22	let's assume numbers and solving in increasing order, and the search is trying to answer the question, is a number in the array or not. And, you know, what do you is you	20 21 22	A. Yes.Q. Can you explain how a hash table works? In general terms.

8 (Pages 26 - 29)

 16 over here, you know, usually what a key 17 represents is some way of describing, you 18 know, the data they would like to store. So 19 usually you talk about a key value pairs, or 20 like a key is an end file with the data. 21 Sometimes the data can be the key itself. 22 Right? Sometimes the key is just a unique 23 identifier of the data. 24 So what you store in the array or 16 standpoint of a person skilled in the art? 17 A. I think it does make sense, but 18 beyond the type of terms that people, we use 19 in a normal setting. So in the normal 20 setting someone will use a database entry, 21 you know, and query. 22 Q. I'm not trying to quibble over the 23 terminology. I just want to make sure we're 24 speaking the same language. 			J F -~	
2associated with it. So the way you store the data there is you have a function that will map the original, let's say keys into some range, you know, that is bonded from one to the length of that array that you use. Then you apply that function on that key. That gives you an index in the array. And then you pupt the data into that link list table, and then when you search, you have a saccitable way the search proceed?3C. Okay. So now when it comes time to search furces proceed?7you pupt the data into that link list table, and then when you search, you have a saccitable way the search proceeds?3A. So in the typical way, if the actually the way the search proceed?1So this is how you populate a hash table, and then when you search, you have a table, and then you, you know, sequential teement of that array which your hash value fascan that link list to see if that key is as earch in this list to see if that key is there.7M. LUNER: Objection to form. actually the way the search proceed? actual way the search proceed the length of the array, and then you go to the length of the array, and then you go to the link list to see if that key is there or not.10get to a link list to see if that key is there or not.15search furchal they you kend the term "key" ow core mether actual key with the key, store the aubits they reidentical you return back the data. sore representation thereo?20. So each entry on the link list is associated with that sorted array.21reference that's served in the array, or it's some representation thereo?23A. The wey fundamental the key represents in reference to or in or link key represents in reference to or in the key represents				
 a data there is yon have a function that will a map the original, let's say keys into some range, you know, this is bonded from one to the length of that array that you use. Then you apply that function on that key. That gives you an index in the array. And then you put the data into that link list a stociated with that element of the array. So this is how you populate a hash table, and then when you search, you have a laready explained, you know, prior to that. a key, you apply exactly the same function, you have a general with the year you would be there with the key trans in the range from one to the length of the array, and then you go to the link list associated with an element of that array which your hash value maps in the range from one to a secan that ink is to see if that key is there or not. b element of that array which your hash value there or not. c lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array which your hash value there or not. d lement of that array or the key. d lement of that array or the key. d lement of that array, or it's some representation thereof? A. I don't think 1 - 1 fully - 1 d lement of the array, or it's some represents in reference to or in relation to the items that are stored in this array. d nor that, your questing. d point, which is to understand what exactly the key represents in reference to or in relation to the items that are stored in the atray. d matte with parents that we're discussing over here, you kn				
4map the original, let's say keys into some range, you know, that is bounded from one to the length of that array that you use. Then you paply that function on that key. That gives you an index in the array. And then you put the data into that link list associated with that element of the array. At bis is how you populate a hash table, and then when you search, you have a key, you apply exactly the same function, you get to a link list that associated with a table, and then when you search, you have a leement of that array which your hash value aget to a link list to associated with a there or not.No in the typical way, if the actually the way the search proceed? all but you take the key, you apply the hash the link list to associated with a scan of the link list, and duen you go to the link list is associated with a scan of the link list.No in the you apply the hash the link list is associated with a scan of the link list.15element of that array which your hash value maps to; and then you, you know, sequentially scan that link list to see if that key is there or not.It he link list and then you do a sequential the yre identical you return back the data, or the key, it depends on what the values area20No he key - what is a key? Q. So a key is the entirety of the some representation thereof?Q. So each entry on the link list is associated with a single reference works?31reference that's served in the array, or it's some representation thereof?Not hereof?33A. Idon't think 1 - I fully - 1 Q. Sure, sure.Yeag 31 the key represents in reference to or in or relation to the items that are stored in the standpoint of a person skilled in the at??4freference work is wh		•••		
5 range, you know, that is bonded from one to 5 fashion you just described, how does the 6 the length of that array that you use. Then 7 MR. LUNER: Objection to form. 8 gives you an index in the array. And then 9 A. So in the typical way, if the 9 you apply that function on that key. 9 actually the way the search proceeds was 1 So this is how you populate a hash 10 actually the way the search proceed swas 11 So this is how you populate a hash 11 But you take the key. you apply the hash 12 element of that array which your hash value 13 there not. 14 16 element of that array which your hash value 15 scan that link list to see if that key is 17 scan that link list to see if that key is 16 or the key, it depends on what the values 18 there on to. 17 they're identical you return back the data, 19 Q. So by - you used the term "key" 10 or the key, it depends on what the values 19 Page 33 reference that's served in the array, or it's associated with a singer reference work or 20 D. So a key is the entirety or the <t< td=""><td></td><td></td><td></td><td></td></t<>				
6the length of that array that you use. Then you apply that function on that key. That gives you an index in the array. And then you put the data into that link list associated with that element of the array. associated with that element of the array. table, and then when you search, you have a key, you apply exactly the same function, you get to a link list tab associated with a telement of that array which your hash value maps to; and then you, you know, sequentially ts can d then you. you know, sequentially ts can d then you used the term "key" there.6search procees? actually the way the search proceed? actually the way the search proceeds was actually the way the search proceeds was actually the way the search proceeds. That hat is associated with an the search in that is a key? Q. So excley nerve you used the term "key" there.6search in the search and if the search in the search in the search in the search in the search in the store in that, in that sorted array.6search in the search and is the search in the array, or it's some representation thereof? Q. Sure, sure.7Mken speaking in terms of database the day.1reference that's served in the array.Nens preaking in terms of database the day.1The database.2A. I don't think I - 1 fully - I the key represents in reference to in to which is to understand what exactly the key represents in reference to in terms that are stored in this array.1The database.3A. I don't think I - 1 fully - I the actual set are the array or it's soin a very general setting, represen				
7you apply that function on that key. That7MR. LUNER: Objection to form.8gives you an index in the array. And then7MR. LUNER: Objection to form.9you put the data into that link list87A. So in the typical way, if the10associated with that element of tha array.810actualky the way the search proceeds was11So this is how you populate a hash10already explained, you knoy, prior to that.12sex, you apply exactly the same function, you1011But you take the key, you apply the hash13the length of tha array, and then you go to13the length of the array, and then you go to14the link list that is associated with an16actual key with the key stroke there. And if16actual key with the key stroke there. And ifthey're identical you return back the data,17there.10actual key with the systeck there. And if18there.20So each entry on the link list is19actual key with a single reference works?2121Is key what is a key?323reference that's served in the array, or it's336not't think I I fully I337reference that's served in the array, or it's338out, If can you rephrase, repeat it?339Q. Sore, sure.1130reference work, is what is stored in the31reference work, is what is stored on the34don't think you mo				
8 gives you an index in the array. And then 9 you put the data into that link list 9 associated with that element of the array. astociated with that element of the array. actually the way the search proceeds was 11 So this is how you populate a hash already explained, you know, prior to that. 12 table, and then when you search, you have a associated with that element of the array, ou poly exactly the same function, you 14 get to a link list that is associated with an 15 scan of the link list, and you compare the 15 scan of the link list, and you compare the actually with the key stroke there. And if 16 maps to; and then you, you know, sequentially 16 actualkey with the key stroke there. And if 17 scan that link list to see if that key is 17 there or not. 18 or the key, it depends on what the values 18 or the key, it depends on what the values are. 20 So each entry on the link list is 19 Q. So by - you used the term "key" 21 associated with a single reference works? 21 associated with a single reference works? 22 A. The key, the equivalent in my 23 A. I don't think I - I fully - I 3 A. What do you mean b				
9you put the data into that link list9actually the way the search proceeds was already explained, you know, prior to that.1So this is how you populate a hash10already explained, you know, prior to that.12table, and then when you search, you have a teget to link list that is associated with an element of that array which your hash value maps to; and then you, you know, sequentially1016eterment of that array which your hash value maps to; and then you, you know, sequentially1116actual key with the key stroke there. And if there.1217there or not.1018there or not.1019Q. So by - you used the term 'key'' there.1110is key what is a key?1120there.2021So each entry on the link list is array.1222A. The key, the equivalent in my previous example are the numbers that we store in that, in that sorted array.2323reference that's served in the array. or it's some representation thereo?233A. I don't think Your question is fully fleshed to it thich is to understand what exactly point, which is to understand what exactly34point, which is to understand what exactly trepresents is some way of describing, you termes the data.34point, which is to understand what exactly trepresents is some way of describing, you termes the				
10associated with that element of the array. So this is how you populate a hash table, and then when you search, you have a key, you apply exactly the same function, you get to a link list that is associated with an element of that array which your hash value maps to; and then you, you know, sequentially element of that array which your hash value maps to; and then you, you know, sequentially scan that link list to see if that key is there or not.10already explained, you know, prior to that. It was the key, you apply the hash the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the link list and you compare the actual key with the key stroke there. And if scan that link list to see if that key is there.10Is key what is a key? 2.It is key what is key? 2.It is				
11So this is how you populate a hash table, and then when you search, you have a lable, and then you opply the hash function that maps in the range from one to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the length of the array, and then you go to the link list that sascelated with an scan that link list to see if that key is scan that link list to see if that key is there. Q. So by -, you used the term "key" if there or not. Q. So by -, you used the term "key" if there. Q. So by -, you used the term "key" if the key, the equivalent in my previous example are the numbers that we? grey revious example are the numbers that we? Q. So a key is the entirety of the Q. So a key is the entirety of the Q. So a key is an end fully - 1 A. I don't think 1 - 1 fully - 1 So an a very fundamental Rege 31 point, which is to understand what exactly grey results in reference to or in to relation to the items that are stored in this aray.11But you take the key, is you apply the hash the data. So in a very general setting, fright, you know, it's - for all the stuff we the key represents in reference to or in so in a very general setting, fright, you kn				
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24 So what you store in the array or 24 speaking the same language.	22	-	22	O. I m not trying to duitable over the
		Right? Sometimes the key is just a unique		
	22 23 24	Right? Sometimes the key is just a unique identifier of the data.	23	terminology. I just want to make sure we're
	23	Right? Sometimes the key is just a unique identifier of the data. So what you store in the array or	23 24	terminology. I just want to make sure we're speaking the same language.

9 (Pages 30 - 33)

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1	Page 34 were database entry?	1	Page 36 entries.
	A. Or database record.		Q. So I'm not sure I followed that
$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	Q. Or database record, and query?	23	
4	A. And the query.	4	last part. I had understood you to say you
5	Q. Okay. And I will try to stick to	5	compare the query key to each entry on the
6	that terminology throughout today's	6	link list to look for a match.
7	questioning.	7	Do I have that right?
8	A. Okay. So what was your question	8	A. The way the hash table querying
9	again?	9	works, like you apply the hash function, you
10	Q. Okay.	10	get a key; based on that key you go to that
11	So the question I posed, then, was	11	entry in the table, the table of link lists,
12	in the linked list that you were describing,	12	right, so you go to that entry in the table
13	is an individual entry on the linked list	13	that contains that specific link list, and
14	associated with a single database entry or a	14	then you traverse that link list.
15	multiple database entries?	15	Q. Okay. Now how is it that I go
16	A. So in the link list example that I	16	about finding the right entry in the table to
17	gave you usually each entry in the link list	17	then traverse the link list?
18	is associated with a single database entry.	18	A. So I have the hash function that
19	Q. So this hash table search process	19	takes what's called the key or the integer
20	that you're describing, then, the query is	20	that describes that key and maps it into a
21	compared to each entry on the link list to	21	range from one to the length of the hash
22	determine whether there is a match; is that	22	table.
23	correct?	23	Q. Have you personally designed
24	A. In the way I described it, if you	24	software systems that use this kind of hash
25	implement a link list in a standard way, yes.	25	table?
	Page 35		Page 37
1	Q. And if a match is found, what	1	A. Yes, I have.
2	happens at that point?	2	Q. And did you do so in or before
3	A. If a match is found, so you either	3	2000?
4	return to a match is found; or if there is	4	A. Yes, I have.
5	data associated with that record, you know,	5	Q. So we've discussed hash tables and
6	you return the data as well.	6	binary searches.
7	Q. And this is a search process that	7	Are there any other forms of
8	you would characterize as a non-exhaustive	8	non-exhaustive searching you were aware of in
9	process?	9	or before 2000?
10	A. That would be a non-exhaustive	10	A. There are other methods of
11	search.	11	non-exhaustive searches that have been
17		12	developed prior to 2000. I believe the Cox
	Q. What is it about the search that		
13	renders it non-exhaustive?	13	patents describe some of those methods. I
13 14	renders it non-exhaustive? A. So the key element that makes a	14	believe they talk about the k-d trees as an
12 13 14 15	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think	14 15	believe they talk about the k-d trees as an example of a non-exhaustive search. They
13 14 15 16	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that	14 15 16	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a
13 14 15 16 17	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you	14 15 16 17	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a
13 14 15 16 17 18	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash	14 15 16 17 18	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too.
13 14 15 16 17 18 19	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash function right away narrows down to one of	14 15 16 17 18 19	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too. Q. So I should have asked, in the hash
13 14 15 16 17 18 19 20	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash function right away narrows down to one of those link lists, and I would search within	14 15 16 17 18 19 20	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too. Q. So I should have asked, in the hash tables
13 14 15 16 17 18 19 20 21	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash function right away narrows down to one of those link lists, and I would search within that link list. So I never search the rest	14 15 16 17 18 19 20 21	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too. Q. So I should have asked, in the hash tables MR. NEMEC: Strike that.
13 14 15 16 17 18 19 20 21 22	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash function right away narrows down to one of those link lists, and I would search within that link list. So I never search the rest of the video clips in the hash table, that	14 15 16 17 18 19 20 21 22	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too. Q. So I should have asked, in the hash tables MR. NEMEC: Strike that. Q. In the software systems you
13 14 15 16 17 18 19 20 21 22 23	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash function right away narrows down to one of those link lists, and I would search within that link list. So I never search the rest of the video clips in the hash table, that are associated with the different entries.	14 15 16 17 18 19 20 21 22 23	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too. Q. So I should have asked, in the hash tables MR. NEMEC: Strike that. Q. In the software systems you developed in or before 2000 that used hash
13 14 15 16 17 18 19 20 21 22	renders it non-exhaustive? A. So the key element that makes a search to be non-exhaustive is if you think of the hash table in which every row of that table has a link list associated with it, you know, as a result of applying the hash function right away narrows down to one of those link lists, and I would search within that link list. So I never search the rest of the video clips in the hash table, that	14 15 16 17 18 19 20 21 22	believe they talk about the k-d trees as an example of a non-exhaustive search. They talk about clustering as an example of a non-exhaustive search. And then they give a bunch of other examples, too. Q. So I should have asked, in the hash tables MR. NEMEC: Strike that. Q. In the software systems you

10 (Pages 34 - 37)

Karypis

		y pro	
	Page 38		Page 40
1	like a textbook data structure, to store key	1	that key that you obtain by applying that
2	value pairs. I believe the hash table that I	2	hash function. So let's call it original key
3	used is just to store the presence or absence	3	and derived key, right?
4	of a particular key, so.	4	Q. Okay.
5	Q. So was it for storing any	5	A. Go ahead.
6	particular type of data?	6	Q. The derived key being the hash?
7	What I mean by that is text as	7	A. Yes.
8	opposed to audio or video or something like	8	Q. And then this, the hash table
9	that.	9	lookup that was generally known as of 2000,
10	A. So the question has to do with the	10	what you were seeking to do was find an exact
11	software system that I designed?	11	match to your hash, correct?
12	Q. Correct.	12	A. No. The way hash tables are
13	A. The answer is they were not really	13	implemented in that link list what you
14	storing any data.	14	actually store is the original key.
15	Q. In or before 2000, did you ever use	15	Q. Okay. So in the lookup process are
16	a hash table to locate near matches to a key?	16	you looking to match identical keys?
17	A. No, I never did.	17	A. You when you compare the query
18	Q. Was it generally known to people	18	key to each of the record in the link list,
19 20	skilled in the art in or before 2000 that you	19 20	so you look to match the identical keys, you
20 21	could use hash tables to find a near match	20	know, in the original, of the original keys.
21 22	between a query key and a database reference? MR. LUNER: Objection to form.	21 22	Q. So in practice, a non-exhaustive
			search would take the form of an algorithm
23 24	A. So the question is about finding a	23 24	implemented in the software, right?
24 25	near match, correct, between the query key and the database key, right.	24 25	A. I would expect so, yes.Q. Dr. Cox doesn't disclose any
23		23	Q. DI. Cox doesn't disclose any
1	Page 39	1	Page 41
1	Q. Correct.	1	specific non-exhaustive search algorithms in
$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	A. No, prior to 2000 there were some, you know, I would say early work or some work	2 3	his patents, does he? A. You mean he describes a bunch of
3			
4			
4	on using specifically design hash functions	4	non-exhaustive search algorithms. I presume
5	on using specifically design hash functions that would allow you to do something like	4 5	non-exhaustive search algorithms. I presume that means discloses right?
5 6	on using specifically design hash functions that would allow you to do something like that.	4 5 6	non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of
5 6 7	on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key	4 5 6 7	non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct?
5 6 7 8	on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash	4 5 6 7 8	non-exhaustive search algorithms. I presume that means discloses right?Q. He describes categories of algorithms, correct?A. I think he describes some specific
5 6 7 8 9	on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000?	4 5 6 7 8 9	non-exhaustive search algorithms. I presume that means discloses right?Q. He describes categories of algorithms, correct?A. I think he describes some specific algorithms. I believe he talks about k-d
5 6 7 8 9 10	on using specifically design hash functions that would allow you to do something like that.Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000?A. That would be correct.	4 5 6 7 8 9 10	non-exhaustive search algorithms. I presume that means discloses right?Q. He describes categories of algorithms, correct?A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are,
5 6 7 8 9 10 11	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query 	4 5 7 8 9 10 11	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific
5 6 7 8 9 10 11 12	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not 	4 5 6 7 8 9 10 11 12	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms.
5 6 7 8 9 10 11 12 13	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work 	4 5 6 7 8 9 10 11 12 13	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for
5 6 7 8 9 10 11 12 13 14	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? 	4 5 6 7 8 9 10 11 12 13 14	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of
5 6 7 8 9 10 11 12 13 14 15	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? A. If I understood your question 	4 5 6 7 8 9 10 11 12 13 14 15	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of ways, right?
5 6 7 8 9 10 11 12 13 14 15 16	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? A. If I understood your question correctly, what you're asking is a fall line, 	4 5 6 7 8 9 10 11 12 13 14 15 16	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of ways, right? A. Yes.
5 6 7 8 9 10 11 12 13 14 15 16 17	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? A. If I understood your question correctly, what you're asking is a fall line, is actually, repeat your question, because 	4 5 6 7 8 9 10 11 12 13 14 15 16 17	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of ways, right? A. Yes. Q. And Dr. Cox doesn't disclose any
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5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? A. If I understood your question correctly, what you're asking is a fall line, is actually, repeat your question, because I don't think I understood your question. Q. Sure. The key, the key, and I'll back up a little bit. The key is derived from a larger set of data, correct?	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of ways, right? A. Yes. Q. And Dr. Cox doesn't disclose any specific way of implementing a k-d tree, for example, right? A. I don't recall if he does. Q. He doesn't disclose a specific way
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5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? A. If I understood your question correctly, what you're asking is a fall line, is actually, repeat your question, because I don't think I understood your question. Q. Sure. The key, the key, and I'll back up a little bit. The key is derived from a larger set of data, correct? A. Again, there are two keys that we are talking about here, right? So one is the 	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of ways, right? A. Yes. Q. And Dr. Cox doesn't disclose any specific way of implementing a k-d tree, for example, right? A. I don't recall if he does. Q. He doesn't disclose a specific way of implementing any other non-exhaustive algorithm, right?
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	on using specifically design hash functions that would allow you to do something like that. Q. But generally speaking, the key matching that would take place in the hash table would be exact matching, as of 2000? A. That would be correct. Q. But an exact match between a query key and a key in the database may not correspond to an exact match between the work from which the key was derived, correct? A. If I understood your question correctly, what you're asking is a fall line, is actually, repeat your question, because I don't think I understood your question. Q. Sure. The key, the key, and I'll back up a little bit. The key is derived from a larger set of data, correct? A. Again, there are two keys that we	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 non-exhaustive search algorithms. I presume that means discloses right? Q. He describes categories of algorithms, correct? A. I think he describes some specific algorithms. I believe he talks about k-d trees and vantage point trees. So those are, you know, I mean they are specific algorithms. Q. Understood. And a k-d tree, for example, could be implemented in a variety of ways, right? A. Yes. Q. And Dr. Cox doesn't disclose any specific way of implementing a k-d tree, for example, right? A. I don't recall if he does. Q. He doesn't disclose a specific way of implementing any other non-exhaustive

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		J P 10	
1	Page 42	1	Page 44
1	Q. Do you understand Dr. Cox to have	$\begin{vmatrix} 1 \\ 2 \end{vmatrix}$	right, within a song that the query matches,
$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	disclosed any new type of non-exhaustive	23	right, then, you know, that segment would be
3	search algorithm?	4	the result of the query.
4	A. I do not recall Dr. Cox disclosing	5	Q. In your experience have you ever
5	any new algorithm for a non-exhaustive search.		heard a search that looks at every entry in a
6		6	reference database characterized as a
7	Q. You understand that the Patent	7	non-exhaustive search?
8	Trial and Appeal Board has proposed a	8	MR. LUNER: Can you repeat the
9	construction of the term "non-exhaustive" for	9	question?
10	use in these proceedings, correct?	10	MR. NEMEC: Sure.
11	A. Correct.	11	Q. In your experience, have you ever
12	Q. And the board has stated that "The	12	heard a search that looks at every entry in a
13	non-exhaustive search should be construed as	13	reference database characterized as a
14	a search that locates a match without	14	non-exhaustive search?
15	comparison to all possible matches," right?	15	A. So if the goal of that query was to
16	I think you might be looking for	16	return an entry in the database as a result,
17	the chart of the constructions in your	17	like, what you described is an exhaustive
18	report. It's	18	search.
19	A. It's page 39.	19	Q. So you think a person of ordinary
20	Q. Yes. That's the one you're looking	20	skill in the art would be incorrect to
21	for?	21	characterize a system that looks at every
22	A. Yes.	22	entry in the database as a non-exhaustive
23	So I believe you said a search that	23	search?
24	locates a match without a comparison of all	24	A. So again, if the result of that
25	possible matches, right? Yep.	25	query was to identify an entry in the
1	Page 43	1	Page 45
1 2	Q. What do you understand "possible matches" to mean in that definition?		database, so yes, that would be an incorrect characterization.
2 3		23	
4	A. So by possible matches in the definition my understanding of that would be	4	Q. And what if the search looked at
4 5	definition, my understanding of that would be what is the result of a query. I believe in	5	every entry in the database but only looked
6	both the Cox patents as well as some of the	6	at one byte of data in each entry in the database; would it still be correct to
	-		
7	patents that Ghias and Iwamura, the result of	7	characterize that as a non-exhaustive search?
8 9	the query is, let's say a record, is a malady. Bight So that part right is a	8	A. So a query that looks at every
9 10	melody. Right. So that part, right, is a possible match.	9	entry in the database, right, even if it only
	1	10	looks at a subset of the data in each entry
11 12	Q. So a possible match is something that would it's something in the data set	11 12	in the database, right, will still be an exhaustive search.
12 13	that would, it's something in the data set		
13 14	that would correspond to the query; is that	13	Q. And that's true even in the
14 15	an accurate way of putting?	14	circumstance where the query you are looking
15 16	A. I mean possible match is something	15	for in the database is one byte, and each
16 17	in the database that can potentially be	16	entry in the database is ten megabytes?
17	returned as an answer to a query. Ω	17	A. Again, if the goal of the query was
	Q. So if we're querying a database of	18	to identify one of those records, right, so
19 20	songs, and the system returned a statement	19	the fact that it only compares one byte and still has to go through all the records in
20	that the query matched the last ten seconds	20 21	still has to go through all the records in
		1 / 1	the database, that still will be a
21	of a song in the database, then what would be		
21 22	the match?	22	non-exhaustive search excuse me, will
21 22 23	the match? MR. LUNER: Objection to the form.	22 23	non-exhaustive search excuse me, will still be an exhaustive search.
21 22	the match?	22	non-exhaustive search excuse me, will

12 (Pages 42 - 45)

Page 46Page 461is able to determine that 75 of the 1002A. Yes.3Q. You're confident that in all the4presentations you've given and papers you've4in a different way?7MR. LUNER: Objection, form.8A. It's hard for me to recall every9single apper 1 wrote and every presentation 110gave, but I believe to a large extent that's11my, you know, that's my definition of an12exhaustive search, the one that would search13every record, right.14Q. So it's possible that there may be15other ways in which you've used the term16"non-exhaustive" throughout your career; is17MR. LUNER: Objection, form.18for, right, if 1 applied exactly the same19A. I can be possible, but I don't20Do you believe a person skilled in21A. I can be possible, but I don't22Q. Do you believe a person skilled in23each entry is searched as non-exhaustive?24A. Okay.25Q. So the determination of which26Do you see that?27Q. And then you, say, "A28had been submitted before, vencel??29A. Heals way Indy bin your30declaration, if you would, Exhibit 1.31an obe as ubmitted before, would have been32searched durin due comparison proces,"34A. Okay.35Do you see that?<		Ku	ypis	
2 A. Yes.' 2 records need not be searched? 3 Q. You're confident that in all the 4. Well, the algorithm will not 4 presentations you've given and papers you've 5 5 in a different way? 5 6 in a different way? 5 7 M.R. LUNER: Objection, form. 6 8 A. T's hard for me to recall every 5 9 single paper I wrote and every presentation I 7 10 gave, but I believe to a large extent that's 10 11 gave, but I believe to a large extent that's 11 12 exhaustive search, the one that would search 12 13 every record, right. 11 4. So in the bash table example that I 14 Q. So it's possible that there may be 16 7 15 otter ways in which you're used the term 17 8 A. Wel, the algorithm will not 16 onto be searched? 14 A. So in the bash table example that I 16 onto resultany other uses. 16 17 18 18 19 approach to generate the hash key, right, approtach to generate the hash ke		-		*
3Q. You're confident that in all the 4 presentations you've given and papers you've authored you've never defined non-exhaustive in a different way?3. A. Well, the algorithm will not necessarily determine 75 percent, but it will of the data will not need to be searched.6in a different way?67MR. LUNER: Objection, form. 1088A. It's hard for me to recall every 959single paper I wrote and every presentation 1 11910gave, but I belive to a large extent that's 1 11011Q. So its possible that there may be other ways in with you've used the term 161014Q. So its possible that there may be other ways in with you've used the term 171416"non-exhaustive" throughout your career; is 171417K. LUNER: Objection, form. 19A. It can be possible, but I don't 101619A. It can be possible, but I don't 121010Q. Do you believe a person skilled in declaration, if you would, Exhibit 1. A. Okay.1121A. Thelieve that would be incorrect. 2Q. Take a look at paragraph 80 in your declaration, if you would, Exhibit 1. A. Okay.1121A. Thelieve that would be incorrect. 2Q. Bo you see that? 4231database.20No the same key that if any other record withich the same key that lowed to incorrect. 22Q. Take a look at paragraph 80 in your declaration, if you would. Exhibit 1. A. Neas.1132O to that example to an				
4 presentations you've given and papers you've 4 necessarily determine 75 percent, but it will 5 authored you've never defined non-exhaustive 5 determine that, you know, a, potentially a 6 in a different way? 6 subset of the data will not need to be 7 MR. LUNER: Objection, form. 8 Q. In your example it was 75 of 100. 9 single paper 1 wrote and every presentation 1 0 Na ves. 10 gave, but I believe to a large extent that's 10 A. Yes. 12 exhaustive search, the one that would search 12 O. So how would the algorithm go about 12 exhaustive" throughout your career; is 10 Na trace hoe possible, but 1 don't 15 other ways in which you've used the term 15 other ways in which you've used the term 16 "mon-exhaustive" throughout your career; is in a choe possible, but 1 don't 14 A. So in the hash table example that 1 17 P. Do you believe a person skilled in 19 approach that I outlined before, would have been 20 Do you believe a paragraph 80 in your 24 14 and tabase. 24 21 A. Teak a look at paragraph 80 in				
5 authored you've never defined non-exhaustive 5 determine that, you know, a, potentially a 6 in a different way? 5 determine that, you know, a, potentially a 7 MR, LUNEE: Objection, form. 8 Q. In your example it was 75 of 100. 9 single paper I wrote and every presentation I 9 That's why I used that. 10 gave, but I believe to a large extent that's 9 That's why I used that. 11 Q. So its possible that there may be 0 A. Yes. 12 other ways in which you've used the term 10 any the record, using the 16 "non-exhaustive" throughout your career; is 11 Q. So its possible, but I don't 13 MR, LUNEE: Objection, form. 14 A. It can be possible, but I don't 14 Q. Do you believe a person skilled in 14 approach to generate the hash key, right, 14 Do you seltieve a person skilled in 14 that would get me to a link list that I know 12 thad theat canon if you would, Ekhibit I. 4 A. Okay. 14 A. Okay. Q. So the determination of which 15 Do you see that? A. So the determination of wh		с.		
6in a different way? MR. LUNER: Objection, form.6subset of the data will not need to be searched.7MR. LUNER: Objection, form.9J. In your example it was 75 of 100.9single paper I wrote and every presentation I9That's why I used that.10gave, but I believe to a large extent that's0A. Yes.11q. So it's possible that there may be that which you're used the term inon-exhaustive "throughout your career; is that what you're saying?A. So in the hash table example that I gave you, so if I load the records, using the approach to generate the hash key, right, to recall any other uses.12Q. Do you believe a person skilled in each entry is searched but only a fraction of the data in each entry is searched but only a fraction of the data in each entry is searched as non-exhaustive?11A. I believe that would be incorrect. Q. Take a look at paragraph 80 in your declaration, if you would, Exhibit I. A. Yes, I do.12M. A. Yes, I do.1records in a that what where not to look until we know what we're looking for, correct?1A. Yes, I add that you, say, "A 1110A. Yes. I' A. Yes, I read that Yes.2A. Yes, I read that Yes.103Q. In that example you refer to a intelligent algorithm to exclude 75 records from the search such that only 25 would be account in deciding which entries to search action, if you would head that would head that in a would head as it aken into account in deciding which entries to search ad which not to search, correct?1A. Yes, I read that. Yes.10 <t< td=""><td></td><td></td><td>1</td><td>•</td></t<>			1	•
7MR. LUNER: Objection, form.7searched.8A. It's hard for me to recall everyQ. In your example it was 75 of 100.10gave, but I believe to a large extent that's1011my, you know, that's my definition of an1112exhaustive search, the one that would search1013every record, right.1014Q. So it's possible that there may be1115other ways in which you've used the term1316'non-exhaustive' throughout your career; is1417that what you're saying?1418MR. LUNER: Objection, form.1719A. It can be possible, but I don't1920recall any other uses.1121Q. Do you believe a person skilled in1922approach to generate the hash tkey, right,23search where every enry in the database is24searche where every enry in the database is25Q. Do you believe a person shilled in26accharatrio, if you would, Exhibit 1.3A. I believe that would be incorrect.2Q. And then you, say, "A7A. Okay.7A. Disen the earch such that only 25 would be8Do you see that?9A. Yes, Irad.10Q. And then you, say, "A11non-exhaustive search could use an12bo you see that?13from the search such that only 25 would be14A. Yes, Irad that. Yes.15 <td></td> <td>-</td> <td></td> <td></td>		-		
8 A. It's hard for me to recall every 8 Q. In your example it was 75 of 100. 9 single paper I wrote and every presentation I 9 That's why lused that. 11 gave, but I believe to a large extent that's 11 A. It's may definition of an 12 exhaustive search, the one that would search 12 determining what subset of information need 12 exhaustive information of an 12 determining what subset of information need 14 Q. So it's possible that there may be 13 not be searche? 14 Q. So it's possible that there may be 14 A. So in the hash table example that I 15 other ways in which you've used the term 16 approach that I outlined before, then given a 16 "nor.exhaustive" into database is searched but only a fraction of the data approach that I outlined before, then given a 20 Do you believe a person skilled in 17 that would be incorrect. 18 for, right, if I applied exactly the same 21 that bear appargarph 80 in you page 49 put in the same link list, so let me research 24 that would be incorrect. 1 records in the database can be excluded from 1		•	6	subset of the data will not need to be
 9 single paper I wrote and every presentation I 10 gave, but I believe to a large extent that's 11 mov, vou know, that's my definition of an 12 exhaustive search, the one that would search 13 or the same lank list is my definition of an 14 Q. So it's possible that there may be 15 other ways in which you've used the term 16 'non-exhaustive' throughout your career; is 17 that's why I used that. 18 O. So how would the algorithm go about 12 determining what subset of information need 13 not be searched? 14 A. So in the hash table example that I 15 gave you, so if I load the records, using the 16 approach that I outlined before, then given a 19 approach to generate the hash key, right, 10 Do you believe a person skilled in 12 the art would be incorrect to characterize a 14 A. I believe that would be incorrect. 14 A. I believe that would be incorrect. 15 Q. In that example you refer to a 16 declaration, if you would, Exhibit I. 16 A. Yes, I cad ther, you, say, "A 17 database. 18 Do you see that? 19 A. Yes, I cad that. Yes. 11 non-exhaustive search could use an 12 intelligent algorithm to exclude 75 records 13 from the search such that only 25 would be 14 A. Stes. Tim just reading this now. 15 A. That is not the case, because the 16 A. Yes. Tim just reading this now. 17 Yes, I read that. Yes. 18 Q. So in this example, how would the 19 intelligent algorithm you were referring to 19 og about excluding 75 records from the 20 So in this example, how would the 21 general terms, then, how is it 22 Hat is not the case, because the 23 you would be an example I just gave 24 Q. In general terms, then, how is it 				
10 gave, but I believe to a large extent that's my, you know, that's my definition of an exhaustive search, but one that would search it 10 A. Yes. 11 my, you know, that's my definition of an every record, right. 10 A. Yes. 13 every record, right. 11 Q. So it's possible that there may be other ways in which you've used the term "non-exhaustive" throughout your career; is that what you're saying? A. So in the hash table example that I gave you, soi I load the records, using the approach that I outlined before, then given a key that I would like to locate the record for, right, if I applied exactly the same approach to generate the hash key, right, that would get me to a link list that I know that would get me to a link list, so let me research that link list. 10 0 you believe a person skilled in each entry is searched as non-exhaustive? 10 11 Page 47 records in the database can be excluded from the satch entry is search dat an each entry is search dat paragraph 80 in your declaration, if you would, Exhibit 1. 10 11 A. Okay. Page 47 12 records in the database can be excluded from the search sud then you, say, "A non-exhaustive search could use an intelligent algorithm to exclude 75 records in trelligent algorithm you were referring to go about excluding 75 records from the search? 10 A. Twe hash table example fust gave you, that, you know, I do not take into account the of every entry in the database is search itme to figure out what to search corect? 13<		A. It's hard for me to recall every		Q. In your example it was 75 of 100.
11Q. So how would the algorithm go about12every record, right.14Q. So it's possible that there may be15other ways in which you've used the term16"non-exhaustive" throughout your career; is17key that loudlined before, then given a18MR. LUNER: Objection, form.19A. It can be possible, but I don't20that would be incorrect to characterize a21each entry is searched but only a fraction of the data in22the art would be incorrect.24searched but only a fraction of the data in25Q. Take a look at paragraph 80 in your26declaration, if you would, Exhibit I.27A. I believe that would be incorrect.2Q. In that example you refer to a3database.3bo you see that?9A. Yes, I do.10Q. And then you, say, "A11Do you see that?12intelligent algorithm to exclude 75 records13from the search such that only 25 would be14A. Yes, I Tadi that. Yes, I'read that. Yes,15Do you see that?16A. Yes. I'read that. Yes,17Yes, I'read that. Yes,18Q. So in this example, how would the19inelligent algorithm to exclude 75 records10go so in this example, how would the11non-exhaustive search such that only 25 would be12inelligent algorithm you were referring to13go son this example, how would				•
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24 Q. In general terms, then, how is it 24 where not to search, correct?				
25 III unat nash table example that the algorithm 25 MR. LUNER: Objection to form.	04	\bigcirc In compared to mark the set 1 \cdot 't		

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	Kar	ypis	
	Page 50		Page 52
1	A. Not in the hash table example I	1	something in common with respect to the key,
2	gave you.	2	right. So there has to be some property of
3	Q. What about other examples?	3	the key that, you know, put those guys in the
4	A. I cannot think off the top of my	4	same bucket.
5	head of a method that would take into account	5	Q. That property of the key is in some
6	all the entries in the database during the	6	fashion representative of the records in that
7	query phase, in order to determine what to	7	bucket, correct?
8	search and what not to search.	8	A. Again, if we take the very generic
9	(Discussion off the record.)	9	view of a record consisting of a key and some
10	A. In order to determine what to	10	data, right, you know, and the key is a way
11	search and what not to search.	11	of retrieving the data which may or may not
12	Q. So the hash table is the only	12	be similarly be associated with the data,
13	example that comes to mind?	13	then the answer to your question is no.
14	A. I'm sorry, but I thought your	14	Q. Something about that key that
15	question was for an example of the algorithm,	15	represents the bucket is indicative of
16	right? So your question was what was your	16	whether our search should consider the
17	question?	17	entries in that bucket; isn't that correct?
18	Q. Well, I'll ask it a different way.	18	A. Can you repeat your question again?
19	Aside from a hash table, can you	19	Q. Sure. Something about the key that
20	think of any other intelligent algorithm by	20	represents the bucket of records is
21	which you could exclude 75 records from a	21	indicative of whether, in a given search, the
22	100-record database and focus only on the	22	contents of that bucket should be examined,
23	remaining 25?	23	right?
24	A. A method like a k-d tree or any	24	A. That depends on the data search
25	other space-partitioning method, you know,	25	that you use or the method that you use. For
	Page 51		Page 53
1	form category.	1	instance, in a hash table, each, it's the
2	Q. So how would a space-partitioning	2	hash value of the original key that returns
3	method like this allow us to exclude records	3	the bucket. So that may lead to buckets
4	from the search?	4	containing records which hash key value is
5	A. So a space-partitioning method is,	5	the same, right. So if that's what you mean
6	you know, is to a large extent similar ideas	6	by indicative, yes, a hash table that falls
7	like a hash table; but what you do is you	7	in the same bucket are keys such that the
8	split each of the dimensions of, you know, a	8	hash value hash key values are the same.
9	high-dimensional feature, right, or a	9	Q. So then in the search process, we
10	multidimensional feature, right, so that you	10	would be looking for a correspondence between
11	store the data in the appropriate buckets	11	the query and the key to determine whether to
12	based on the dimensions of the record, of the	12	further consider the contents of a given
13	key of the record, and then you use exactly	13	bucket; is that right?
14	the same approach to select the buckets.	14	MR. LUNER: Objection to form.
15	Q. So the decision of what database	15	A. I mean a query consists of, I
16	records go in what bucket is based on the	16	presume, a key, right? So when you say
17	nature of the database records, right?	17	between a query and a key, what do you mean?
18	A. The decision of which database	18	Q. Well, let me step back from this a
19	record goes to which bucket is a function of	19	bit, and let's put aside the hash table for a
20	the, of the key associated with that	20	moment.
21	database, right.	21	A. Okay.
22	Q. So all the database records in a	22	Q. And let's talk about this, the
23	given bucket have something in common with	23	space-partitioning example.
24		04	4 01
24	one another, correct?	24	A. Okay.
24 25	one another, correct? A. They all the records have	24 25	A. Okay.Q. In the space-partitioning example,

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		y pro	
	Page 54		Page 56
1	and correct me if I'm wrong, but you are	1	assuming my decision tree has X, Y and Z, in
2	essentially creating a decision tree with	2	that order. So go down in X and within that
3	intelligently organized information down the	3	X bucket, as I say, with my range, you know,
4	various branches of the tree, correct?	4	I will branch, take the path associated with
5	A. So the decision tree is a correct	5	the Y bucket, and then within that, I will
6	analogy. The level of intelligence is up	6	take the branch that's in the Z bucket.
7	from the partition, but the decision tree is	7	Q. If you had a reference database
8	a good way of thinking about it.	8	containing a single entry, would it be
9	Q. So it's organized in some fashion	9	possible to non-exhaustively search that
10	such that information with some quality in	10	database?
11	common is down one branch, and information	11	A. I'm sorry. Your question was if I
12	with a different quality in common is down a	12	had a database consisting of one entry, will
13	different branch, right?	13	it be possible to search it in a
14	A. So it's organized such that, you	14	non-exhaustive way?
15	know, keys, right, to then put certain	15	Q. Correct.
16	dimensions for certain characterization would	16	A. The example that I gave you, from
17	fall into one branch of the tree versus the	17	both a hash table and as well as, you know,
18	other.	18	space-partition method, even if I had a
19	Q. Okay. So now when we're looking to	19	single entry, I can still, you know, my
20	search that tree, we start with a query. And	20	search, I'm not even going to examine that
21	our goal is to if there's anything in the	21	area, that entry under certain conditions.
22	tree that matches the query, right?	22	Q. Is that because you are considering
23	A. Correct.	23	there would be empty branches, for example,
24	Q. So we need to decide which branches	24	in the
	-		
25	are worth looking down in this organized	25	A. In the empty branches, there can be
25	are worth looking down in this organized	25	A. In the empty branches, there can be
	Page 55		Page 57
1	Page 55 tree, correct, and which ones we can ignore?	1	Page 57 empty link lists in the hash table.
1 2	Page 55 tree, correct, and which ones we can ignore? A. So the way the space-partitioning	1 2	Page 57 empty link lists in the hash table. Q. If you had a database with, if you
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1 2 3 4	Page 55 tree, correct, and which ones we can ignore? A. So the way the space-partitioning methods work, based on the dimensions of the key, the Pk could be one path down the tree.	1 2 3 4	Page 57 empty link lists in the hash table. Q. If you had a database with, if you had a music database that contained one entry with 100 songs appended back to back, would
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1	Page 58	1	Page 60
1	Q with a single entry containing a	1	over here, right. But one possibility for
2	file of 100 songs appended back to back.	2	something like that is to create, you know,
3	Do you understand?	3	some sort of a, you know, like some sort of
4	A. Sure.	4	an index or something, you know, that relates
5	Q. And the question is: Is it	5	to it that will extract, you know, from that
6	possible to non-exhaustively search that	6	single record, you know, some signature of
7	database to determine whether a particular	7	those subsets and then, you know, use those
8	song is present?	8	signatures, put them into some sort of a hash
9	A. So what are the keys associated	9	table or space-partitioning structure,
10	with that one	10	generate exactly the same thing for my query;
11	Q. Pardon?	11	and then if I've never seen something like
12	A. What is the key associated with	12	that in the past, then I can answer no
13	that one entry?	13	without searching another single item.
14	Q. What is the key associated with it?	14	Q. Turning back to your example in
15	I'm not specifying any particular structure.	15	paragraph 80 with the 100-record database
16	In general, is it possible to	16	whereby you are able to exclude 75 records,
17	construct an algorithm that would search that	17	the process of excluding those 75 records is
18	database in a non-exhaustive fashion?	18	not a random selection process, correct?
19	A. If I understand your question	19	A. By "random selection," what do you
20	correctly, so what you're asking is the	20	mean?
21	following; if I have a single record	21	Q. You don't just randomly exclude 75
22	containing some data, right, and I would like	22	records from the search, in order to narrow
23	to perform a query that will tell me whether	23	the search set?
24	or not that record contains a certain subset,	24	A. There can be methods that, you
25	that is the query that we are asking over	25	know, they will, can exclude a random subset
123	that is the query that we are asking over	45	Know, they will, can exclude a fandom subset
23		25	•
	Page 59		Page 61
1	Page 59 here?	1	Page 61 and then can provide some probabilistic
1 2	Page 59 Q. Correct.	1 2	Page 61 and then can provide some probabilistic recovery damages.
1 2 3	Page 59 here? Q. Correct. A. Can a single record database,	1 2 3	Page 61 and then can provide some probabilistic recovery damages. Q. So there are approaches where you
1 2 3 4	Page 59 here? Q. Correct. A. Can a single record database, right, solve a nonsubset problem using a	1 2 3 4	Page 61 and then can provide some probabilistic recovery damages. Q. So there are approaches where you could just randomly exclude a certain number
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16 (Pages 58 - 61)

		J I	
	Page 62		Page 64
1	Q. So what you want is a system where	1	recovery of the records, whether that record
2	you know enough about each record in the	2	exists, without having to look at anything
3	database to make a determination as to	3	else.
4	whether or not to examine that particular	4	MR. LUNER: Is it a time for a
5	record, when presented with a given query,	5	break?
6	correct?	6	MR. NEMEC: Sure. I was just
7	A. Repeat your question again, because	7	noticing it was 10:38.
8	I don't think I follow.	8	THE VIDEOGRAPHER: The time is
9	Q. Sure. A system, in designing a	9	10:36. We're going off the record.
10	non-exhaustive search system, what you want	10	This will be the end of disk number 1.
11	is an arrangement whereby you know something	11	(A brief recess was taken.)
12	about each record in the database such that	12	THE VIDEOGRAPHER: The time is
13	when presented with a given query, you can	13	10:48. We're back on the record. This
14	make a determination of whether or not to	14	is the beginning of disk number 2.
15	look at the content of that record?	15	Q. Dr. Karypis, are you familiar with
16	MR. LUNER: Objection to form.	16	the term "linear search"?
17	A. No, that is not how a	17	A. Yes.
18	non-exhaustive method work. I mean in your	18	Q. That's a search that or, pardon
19	example, you still tie the determination of	19	me, that's a term that you used in your
20	not looking something by, you know, making a	20	declaration in this case, right?
21	decision about each record at query time. I	21	A. Yes.
22	mean non-exhaustive search, which at that	22	Q. Is a linear search an exhaustive
23	point in time, you know, the fact that I have	23	search?
24	to make a determination of not to look	24	A. So the term "linear search" is used
25	something by looking at every object, every	25	to characterize the complexity of an
	Page 63		Page 65
1	record, that would still be an exhaustive	1	algorithm and has nothing to do with whether
2	search.	2	an algorithm does or it doesn't
3	A non-exhaustive search is a search	3	Q. I didn't hear the last part, I
4	that it only looks at a subset, right, of	4	apologize.
4 5	that it only looks at a subset, right, of let's say the records, comes up with some	4 5	apologize. A. The term linear search has to do
4 5 6	that it only looks at a subset, right, of let's say the records, comes up with some matches; and it doesn't do anything with the	4 5 6	apologize.A. The term linear search has to dowith characterizing the complexity of the
4 5 6 7	that it only looks at a subset, right, of let's say the records, comes up with some matches; and it doesn't do anything with the rest, not even going through to simply	4 5 6 7	apologize.A. The term linear search has to dowith characterizing the complexity of thealgorithm and has nothing to do with whether
4 5 6 7 8	that it only looks at a subset, right, of let's say the records, comes up with some matches; and it doesn't do anything with the rest, not even going through to simply determine whether or not it would consider	4 5 6 7 8	apologize. A. The term linear search has to do with characterizing the complexity of the algorithm and has nothing to do with whether the search is exhaustive or non-exhaustive.
4 5 6 7 8 9	that it only looks at a subset, right, of let's say the records, comes up with some matches; and it doesn't do anything with the rest, not even going through to simply determine whether or not it would consider that.	4 5 6 7 8 9	apologize.A. The term linear search has to do with characterizing the complexity of the algorithm and has nothing to do with whether the search is exhaustive or non-exhaustive.Q. So it's possible to have a linear
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17 (Pages 62 - 65)

Karypis

1	Page 66 right, a linear an exhaustive search	1	Page 68 different things.
2	algorithm that has to visit every record will	2	Q. Are different, okay.
3	have a complexity that is going to be in the	$\frac{2}{3}$	Now what about in the context of
4	order of the number of records, so it would		
		4 5	the Cox patents, do you understand those
5	be a linear complexity.		terms to be used the same or different?
6	Q. So is a linear search always	6	A. So in the context of the Cox
7	exhaustive is my question?	7	patents the term "linear" or "sublinear"
8	A. If the goal of the search is	8	refers to linear time or sublinear time. At
9	identify a single record, right, in which the	9	which point in time those are measures of
10	fitness of record is determined entirely by	10	complexity, so they are the same things.
11	the record itself, right, an exhaustive	11	Q. Let's take a moment to look at that
12	search would be a linear search.	12	in the patents. We might as well go ahead
13	Q. I think I understand your question,	13	and mark all four patents at this point so
14	but I'm afraid we may be coming at this from	14	that you have them available as they come up.
15	opposite directions.	15	MR. NEMEC: We will mark as Karypis
16	The question that I'm posing is	16	Deposition Exhibit 2, U.S. Patent
17	whether a linear search is always exhaustive.	17	8,010,988.
18	A. So let me give you an example of a	18	Mark as Karypis Exhibit 3, U.S.
19	linear search that may not necessarily be	19	Patent 8,205,237.
20	exhaustive. Okay.	20	Karypis Exhibit 4 will be U.S.
21	If the part of my search is to find	21	Patent 8,640,179.
22	the best combination of K IDs, of K records	22	And Karypis Exhibit 5 will be U.S.
23	in my database. An exhaustive search of that	23	Patent 8,656,441.
24	will have to enumerate, will have to visit	24	(Karypis Exhibit 2, Photocopy of
25	every, every potential, you know, match,	25	U.S. Patent No. 8,010,988, marked for
			, , , ,
	Page 67		Page 69
1	Page 67 right? So it would be every potential K	1	
	Page 67 right? So it would be every potential K subset, so that would be an exhaustive	1 2	Page 69 identification, this date.)
1	right? So it would be every potential K subset, so that would be an exhaustive		Page 69
1 2	right? So it would be every potential K	2	Page 69 identification, this date.) (Karypis Exhibit 3, Photocopy of U.S. Patent No. 8,205,237, marked for
1 2 3	right? So it would be every potential K subset, so that would be an exhaustive search, which complexity is now going to be	2 3	Page 69 identification, this date.) (Karypis Exhibit 3, Photocopy of U.S. Patent No. 8,205,237, marked for identification, this date.)
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1 2 3 4 5 6	right? So it would be every potential K subset, so that would be an exhaustive search, which complexity is now going to be linear than on the records, you know.	2 3 4 5 6	Page 69 identification, this date.) (Karypis Exhibit 3, Photocopy of U.S. Patent No. 8,205,237, marked for identification, this date.) (Karypis Exhibit 4, Photocopy of U.S. Patent No. 8,640,179, marked for
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	 right? So it would be every potential K subset, so that would be an exhaustive search, which complexity is now going to be linear than on the records, you know. Q. Is it typical in the art to determine a linear search as a sequential search of all N entries in the database? A. So can you repeat your question again. Q. Is it typical in the art to define a linear search as a sequential search of all N entries in a database? A. So a search that has a linear complexity, okay, and if its goal is to return a single result, right, you know, then a linear search under those conditions, you know, will lead to a sequential scan. Q. So you've mentioned a couple of times the concept of linear complexity, and my question is simply about the term a linear search. 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	Page 69 identification, this date.) (Karypis Exhibit 3, Photocopy of U.S. Patent No. 8,205,237, marked for identification, this date.) (Karypis Exhibit 4, Photocopy of U.S. Patent No. 8,640,179, marked for identification, this date.) (Karypis Exhibit 5, Photocopy of U.S. Patent No. 8,656,441, marked for identification, this date.) Q. Dr. Karypis, you have the four patents in front of you? A. Uh-huh. Q. Take a look at, if you would, at Exhibit 2, the '988 patent. A. Yes. Q. And in particular column 9. A. Yes. Q. And line 25. Do you see a reference to the term "linear search" there? A. Yes. Q. What do you understand linear

18 (Pages 66 - 69)

1	Page 70 A. So the meaning of linear search in	1	Page 72 Q. Now, in paragraph 83 you're
2	this context is a sequential search.	2	describing a hypothetical search where the
3	Q. A sequential search, okay.	3	query work is ABC, and you're looking in a
4	That's a different concept from the	4	database for records that would match ABC,
5	linear complexity concept that we were	5	correct?
6	discussing a moment ago?	6	A. Very good.
7	A. So linear, it says over here,	7	Yes, so what was your question
8	describes a way of searching. The linear	8	again?
9	time complexity describes the complexity.	9	Q. Just try me out to make sure I'm
10	Q. And when Dr. Cox uses the term in	10	understanding the example that you've
11	his patent here, he's talking about the way	10	provided here.
12		11	A. Yes.
12	of searching, right?	12	
13	MR. LUNER: Objection, form.	13	Q. Query work is ABC, and the database
	Q. Is that how you interpret him using the term?	14	contains strings of letters, correct? A. Correct.
15			
16	A. So the use of term "linear search"	16	Q. And we're looking for a match to
17	over here has to do with the way he refers to	17	ABC in the database?
18	the the way the algorithm scans	18	A. So the records consists of strings,
19	sequentially the entries of the the N	19	right. We won't have a query. And what
20	entries.	20	we're trying to find out is we're trying to
21	Q. And as described here in the Cox	21	find the record that, you know, you know, has
22	patent, that linear search is an exhaustive	22	ABC, whose string is ABC.
23	search, correct?	23	I believe the setup over here is
24	A. So that would be an example of an	24	very simple. I have records consisting of
25	exhaustive search, yes.	25	three-character words, and my query is a
	Page 71		D 72
1 .	-		Page 73
1	Q. Now, if you take the example of a	1	three-character word, and I want to go and
2	Q. Now, if you take the example of a search that considers every entry in a	2	three-character word, and I want to go and find a matching record.
2 3	Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little	2 3	three-character word, and I want to go and find a matching record.Q. And if I look through the database
2 3 4	Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably	2 3 4	three-character word, and I want to go and find a matching record.Q. And if I look through the database in your example to seek a match to ABC, I
2 3 4 5	Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that	2 3 4 5	three-character word, and I want to go and find a matching record.Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database
2 3 4 5 6	Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize	2 3 4 5 6	three-character word, and I want to go and find a matching record.Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with
2 3 4 5 6 7	Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search?	2 3 4 5 6 7	three-character word, and I want to go and find a matching record.Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set.
2 3 4 5 6 7 8	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive 	2 3 4 5 6 7 8	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search
2 3 4 5 6 7 8 9	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every 	2 3 4 5 6 7 8 9	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive?
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2 3 4 5 6 7 8 9 10 11 12	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every entry in every record in the database. Q. Even if you're not looking at enough from each entry to really know whether 	2 3 4 5 6 7 8 9 10 11 12	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive? A. So the fact that I have looked at every record in the database, you know, makes the search to be exhaustive.
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2 3 4 5 6 7 8 9 10 11 12 13 14 15	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every entry in every record in the database. Q. Even if you're not looking at enough from each entry to really know whether a match exists in that entry or not? A. The I believe that's the case. 	2 3 4 5 6 7 8 9 10 11 12 13 14 15	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive? A. So the fact that I have looked at every record in the database, you know, makes the search to be exhaustive. Q. So in your example you would not examine any entry that doesn't begin with A, beyond identifying the fact that that entry
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every entry in every record in the database. Q. Even if you're not looking at enough from each entry to really know whether a match exists in that entry or not? A. The I believe that's the case. Yes, that would be the case. It would be an exhaustive search. Q. So even if we look at a single bit of information in every entry in the database, that's an exhaustive search in your 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive? A. So the fact that I have looked at every record in the database, you know, makes the search to be exhaustive. Q. So in your example you would not examine any entry that doesn't begin with A, beyond identifying the fact that that entry doesn't begin with A, right? A. So in my example, we examine every entry, perform a comparison on the first character and then returns folds of those
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every entry in every record in the database. Q. Even if you're not looking at enough from each entry to really know whether a match exists in that entry or not? A. The I believe that's the case. Yes, that would be the case. It would be an exhaustive search. Q. So even if we look at a single bit of information in every entry in the 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive? A. So the fact that I have looked at every record in the database, you know, makes the search to be exhaustive. Q. So in your example you would not examine any entry that doesn't begin with A, beyond identifying the fact that that entry doesn't begin with A, right? A. So in my example, we examine every entry, perform a comparison on the first
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every entry in every record in the database. Q. Even if you're not looking at enough from each entry to really know whether a match exists in that entry or not? A. The I believe that's the case. Yes, that would be the case. It would be an exhaustive search. Q. So even if we look at a single bit of information in every entry in the database, that's an exhaustive search in your view? 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive? A. So the fact that I have looked at every record in the database, you know, makes the search to be exhaustive. Q. So in your example you would not examine any entry that doesn't begin with A, beyond identifying the fact that that entry doesn't begin with A, right? A. So in my example, we examine every entry, perform a comparison on the first character and then returns folds of those records that did not match. Q. And it will examine further the entries that do begin with A, correct?
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 Q. Now, if you take the example of a search that considers every entry in a multi-entry database but looks at so little of each entry that it can't reliably determine whether a match exists in that entry or not, would you still characterize that as an exhaustive search? A. So that would be an exhaustive search, because you have to look at every entry in every record in the database. Q. Even if you're not looking at enough from each entry or not? A. The I believe that's the case. Yes, that would be the case. It would be an exhaustive search. Q. So even if we look at a single bit of information in every entry in the database, that's an exhaustive search in your view? A. That's an exhaustive search in my 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ \end{array}$	 three-character word, and I want to go and find a matching record. Q. And if I look through the database in your example to seek a match to ABC, I look at the first letter in each database entry and exclude those that don't begin with A, to narrow the data set. Does that step render the search non-exhaustive? A. So the fact that I have looked at every record in the database, you know, makes the search to be exhaustive. Q. So in your example you would not examine any entry that doesn't begin with A, beyond identifying the fact that that entry doesn't begin with A, right? A. So in my example, we examine every entry, perform a comparison on the first character and then returns folds of those records that did not match. Q. And it will examine further the
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		ypis	
	Page 74		Page 76
1	A. Well, that would be done on a	1	non-exhaustively?
2	record-by-record basis. Given a query, given	2	MR. LUNER: Objection to form.
3	a record, first compare the first character	3	A. So the question you're asking is, I
4	of the query and the first character of the	4	have a hypothetical database containing
5	record. If they match, we continue. The	5	strings of length 9, right?
6	second character of the query would be the	6	Q. Right.
7	second character of the record. If there's a	7	A. And my query is a string of length
8	match, we'll continue.	8	3?
9	But if at any given point in the	9	Q. Correct.
10	process there is no match, we terminate, we	10	A. And I want to solve a subset
11	return false, and we move on to the second	11	problem?
12	one.	12	Q. Correct.
13	Q. Without looking further at the	13	A. Substring problem, right? It's a
14	remainder of that reference, correct?	14	substring contained in one of the records.
15	A. You're correct.	15	Q. Right.
16	Q. Now, in your example you're looking	16	A. And your question is, can I think
17	for an exact match to ABC, correct?	17	of a method that would allow me to do that
18	A. In this particular case, I believe	18	thing in a non-exhaustive way?
19	so, yes.	19	Q. Right.
20	Q. What if you were running this	20	A. So the answer to that is yes. This
21	search to look for something that was similar	21	is exactly the same example that, the
22	to ABC?	22	solution approach that I gave you for your
23	A. How will you define "similar"?	23	example of a one single record database.
24	Q. What if we were looking for	24	Q. And how would that, how would it
25	something that had at least two of the	25	work?
	Page 75		Page 77
1			
	letters in sequence in common?	1	A. So if I was to design a system that
2	A. Okay. So in a scenario like that,	2	would allow me to do in that fashion, I will
2 3	A. Okay. So in a scenario like that, in this particular example, I will compare A	2 3	would allow me to do in that fashion, I will for each query in the for each string from
2 3 4	A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially	2 3 4	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring
2 3 4 5	A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes	2 3 4 5	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to
2 3 4 5 6	A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know,	2 3 4 5 6	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of
2 3 4 5 6 7	A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that	2 3 4 5 6 7	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense.
2 3 4 5 6 7 8	A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at	2 3 4 5 6 7 8	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an
2 3 4 5 6 7 8 9	A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any	2 3 4 5 6 7 8 9	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to
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2 3 4 5 6 7 8 9 10 11	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get 	2 3 4 5 6 7 8 9 10 11	would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records
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2 3 4 5 6 7 8 9 10 11 12 13 14 15	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the 	2 3 4 5 6 7 8 9 10 11 12 13 14 15	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the query string and the definition of 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just described, then, you'd consider all the
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the query string and the definition of "similarity" that you have, that would require to actually compare everything, in other words, to not early terminate a comparison. 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just described, then, you'd consider all the extracted index values? A. Not during the query time, if that is what your question is. During the query time I only consider the extracted index
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the query string and the definition of "similarity" that you have, that would require to actually compare everything, in other words, to not early terminate a comparison. Q. What about a system in which your 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ \end{array}$	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just described, then, you'd consider all the extracted index values? A. Not during the query time, if that is what your question is. During the query time I only consider the extracted index values that match my query.
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the query string and the definition of "similarity" that you have, that would require to actually compare everything, in other words, to not early terminate a comparison. Q. What about a system in which your database contained nine-letter strings, and 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just described, then, you'd consider all the extracted index values? A. Not during the query time, if that is what your question is. During the query time I only consider the extracted index values that match my query. Q. So to form the extracted index
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the query string and the definition of "similarity" that you have, that would require to actually compare everything, in other words, to not early terminate a comparison. Q. What about a system in which your database contained nine-letter strings, and your goal was to find the presence of a 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just described, then, you'd consider all the extracted index values? A. Not during the query time, if that is what your question is. During the query time I only consider the extracted index values that match my query. Q. So to form the extracted index values, you take into account the content of
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	 A. Okay. So in a scenario like that, in this particular example, I will compare A with B, right. So but I can potentially have, you know, B and C matching what comes afterwards. So I will continue, you know, comparing until I can reliably determine that that string cannot qualify as a match, at which point in time I will stop examining any more records. Q. In that case you may need to get through every letter in the sequence in every entry in the database to determine whether or not there is a match, correct? A. I would think that depending on the query string and the definition of "similarity" that you have, that would require to actually compare everything, in other words, to not early terminate a comparison. Q. What about a system in which your database contained nine-letter strings, and your goal was to find the presence of a three-letter string in one of the database 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	 would allow me to do in that fashion, I will for each query in the for each string from the database I will extract every substring of length 3, use those substrings to, to create let's say in the context of strings, it would probably make more sense. There's a database structure called an inverted index, which is something similar to a hash table idea; and then given that query string, I will just then search the records that have that and nothing else. That would be an non-exhaustive search. Q. So in the process you just described, then, you'd consider all the extracted index values? A. Not during the query time, if that is what your question is. During the query time I only consider the extracted index values, you take into account the content of each record, correct?
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		J P10	
1	Page 78		Page 80
1	time, you know, I do it, yes.	1	Q. Is it your understanding from the
2	Q. And then at the query time, you	2	disclosure in the Cox patents that Dr. Cox
3	consider only the, only the index values that	3	was not concerned or
4	have something in common with your query?	4	MR. NEMEC: Strike that.
5	A. That is correct.	5	Q was not interested in finding an
6	(Discussion off the record.)	6	exact match in the data sets to be searched?
7	A. That is correct.	7	A. I don't recall that, you know, in
8	Q. I'm going to move on to another	8	the disclosure that it was an explicit
9	term. The term "neighbor" appears in certain	9	statement, saying it's, you know, we do not
10	of the challenge claims of the Cox patents,	10	want the exact match or the closest match.
11	right?	11	Q. Some of the examples Dr. Cox uses
12	A. That is correct.	12	for application of his invention in the
13	Q. As well as "near neighbor"?	13	patents are to identify songs and video
14	A. I believe so.	14	works, correct?
15	Q. And the term "neighbor search" also	15	A. I believe so.
16	appears in some claims?	16	Q. You think it's within the spirit of
17	A. I believe so.	17	that application to ignore exact matches of
18	Q. And "identifying a neighbor"	18	audio or video works in the search process?
10	appears in some claims?	18	MR. LUNER: Objection to form.
			6
20	A. I believe so.	20	A. So again, I'm not very familiar
21	Q. As of 2000, is neighbor searching	21	with those applications from an
22	something that you were familiar with?	22	implementation and from a business
23	A. Yes.	23	standpoint, right; but ignoring the exact
24	Q. Dr. Cox doesn't purport to have	24	matches, right, is you know, those things
25	invented neighbor searching in his patents,	25	exist, right. There should not be, no.
	Page 79		Page 81
1	does he?	1	Q. So if the intent of your system is
2	A. I don't believe so.	2	to identify a song in a database, if that
3	Q. And in fact it was a concept well	3	exact work exists in the database, you're
3	Q. And in fact it was a concept well	3	exact work exists in the database, you're
3 4	Q. And in fact it was a concept well known to people skilled in the art in and	3 4	exact work exists in the database, you're going to want to find it, right?
3 4 5	Q. And in fact it was a concept well known to people skilled in the art in and before 2000?A. That is true.	3 4 5	exact work exists in the database, you're going to want to find it, right? MR. LUNER: Objection to form. A. I mean to a large extent that has
3 4 5 6 7	Q. And in fact it was a concept well known to people skilled in the art in and before 2000?A. That is true.Q. In general, what was neighbor	3 4 5 6 7	exact work exists in the database, you're going to want to find it, right? MR. LUNER: Objection to form. A. I mean to a large extent that has to do with a specific application, right? I
3 4 5 6 7 8	Q. And in fact it was a concept well known to people skilled in the art in and before 2000?A. That is true.	3 4 5 6 7 8	exact work exists in the database, you're going to want to find it, right? MR. LUNER: Objection to form. A. I mean to a large extent that has to do with a specific application, right? I can take scenarios in which given a query, if
3 4 5 6 7 8 9	 Q. And in fact it was a concept well known to people skilled in the art in and before 2000? A. That is true. Q. In general, what was neighbor searching used for as of 2000? A. So I can think of two two 	3 4 5 6 7 8 9	 exact work exists in the database, you're going to want to find it, right? MR. LUNER: Objection to form. A. I mean to a large extent that has to do with a specific application, right? I can take scenarios in which given a query, if there is something identical in your
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1	Page 82 but would also identify an exact match if	1	Page 84
1 2	but would also identify an exact match, if one were present in the data set being	$\begin{vmatrix} 1\\2 \end{vmatrix}$	alpha neighbor search, you know. You identify everybody, right, within a certain
2 3	searched, do you believe a person skilled in	$\frac{2}{3}$	distance of your query or that came more
4	the art would have been correct to	4	similar things and so forth.
4 5	characterize that as a neighbor search?	5	Q. Okay. Would a nearest neighbor be
6	MR. LUNER: Objection.	6	a form of a neighbor?
0 7	A. So I believe this is an issue that	7	
8	I have not addressed in length in my	8	A. If I understand your question, you're asking me is an object, right, that is
9	declaration, and I believe this is addressed	9	the nearest neighbor, whether or not that is
10	in	10	also a near neighbor?
10	Q. Let me stop you for a second.	11	Q. Or a neighbor.
12	Before you consult your	12	A. Or a neighbor.
12	declaration, are you able to answer that	12	What is your definition of a
13	question from your experience in the field?	14	"neighbor"?
14	A. Yeah. I mean so your question,	15	Q. I would prefer to work from your
16	if just to make sure I understand it is,	16	definition of a neighbor as it was understood
17	if I have a search, right, that will return,	17	in the year 2000.
18	in addition to a close match, always an exact	18	So let's start with that.
19	match, would that be a neighbor search or	10	A. I mean the notion of a neighbor,
20	not	20	right, is someone that is close but not
20	Q. Correct.	20	necessarily the best or the optimal solution
21	A correct?	$\frac{21}{22}$	to a search, right, so that would be a
22	So if that search will always	22	neighbor.
23 24	return the exact match, right, that would be,	23	So the optimal solution to a
24 25	that would not be a neighbor search, that	24	search, you know, will definitely be a subset
23	that would not be a heighbor search, that	25	scaren, you know, will definitely be a subset
	Page 83		Page 85
1	would be a, you know, a nearest neighbor	1	of the neighbor. So to answer your question,
2	search. Actually in this case it would be an	2	yes, the closest would be close as well.
3	exact search.	3	Q. Okay. Now as of 2000, would the
4	Q. I'm asking that based on the	4	search that always returned the closest match
		- I	-
5	knowledge of people skilled in the art as of	5	in the database being searched be accurately
6	2000, so separate from how the term may be	6	in the database being searched be accurately characterized as a neighbor search?
6 7	2000, so separate from how the term may be used or defined in the context of the	6 7	in the database being searched be accurately characterized as a neighbor search?A. No, it will not be characterized.
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	Page 86		Page 88
1	guaranteed to return the best result, so the	1	construction in rendering your opinions in
2	nearest neighbor search is not a type of a	2	this case, you have excluded from the
3	neighbor search.	3	definition of "neighbor search" anything that
4	Q. And you say that because of the	4	guarantees identification of an exact or the
5	guarantee that a nearest neighbor search will	5	closest match, correct?
6	return the best result; is that right?	6	A. I have excluded anything that
7	A. Correct, so the nearest neighbor	7	always guarantees identification of the exact
8	search is, you know, we've guaranteed, you	8	or closest match, yes.
9	know, to return the best result, assuming	9	Q. Likewise, in applying your
10	that, you know, you don't have that	10	understanding of the patent office's
11	threshold. I mean the question of whether or	11	construction of identifying a neighbor, you
12	not the nearest neighbor search is to return	12	have excluded anything that guarantees to
13	a result, it will guarantee to return the	13	always return the exact or the closest match?
14	best result.	14	A. So identifying a neighbor refers to
15	Q. And again, is this your view of the	15	the search process, right, so it's a search
16	meaning of the term, separate and apart from	16	method that identifies, always identifies the
17	patent office construction in this case?	17	closest return, say the closest or the exact
18	A. Which term are you referring to,	18	match, right. You know, it's not what I
19	the nearest neighbor search?	19	refer to as identifying a neighbor.
20	Q. Neighbor search.	20	Q. And if the patent office were to
21	A. The neighbor search.	21	determine that a search is guaranteed to find
22	Yeah, my view of the term "neighbor	22	the closest or an exact match qualifies as a
23	search" is independent of the patent office	23	neighbor search in their construction, would
24	constructions, you know, it's actually	23 24	you want to revisit the opinions rendered in
25	they're in agreement.	25	your declaration?
	they to in agreement.	20	jour deelaration.
1	Page 87	1	Page 89
1	Q. So what you're saying is there's no	1	MR. LUNER: Objection to form.
2	Q. So what you're saying is there's no difference between your general understanding	2	MR. LUNER: Objection to form. A. Can you restate your question?
2 3	Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you	2 3	MR. LUNER: Objection to form.A. Can you restate your question?Q. Sure. If the patent office were to
2 3 4	Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to	2 3 4	MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that
2 3 4 5	Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to be; do I have that right?	2 3 4 5	MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that guarantees finding an exact or the closest
2 3 4 5 6	 Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to be; do I have that right? A. So I believe the patent office 	2 3 4 5 6	MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that guarantees finding an exact or the closest match in a data set qualifies as a neighbor
2 3 4 5 6 7	 Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to be; do I have that right? A. So I believe the patent office construction of the neighbor search is a 	2 3 4 5 6 7	MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that guarantees finding an exact or the closest match in a data set qualifies as a neighbor search, would you want to revisit the
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2 3 4 5 6 7 8 9 10	 Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to be; do I have that right? A. So I believe the patent office construction of the neighbor search is a search, right, that is, you know, is guaranteed it's a search that will identify a close but not necessarily the best 	2 3 4 5 6 7 8 9 10	MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that guarantees finding an exact or the closest match in a data set qualifies as a neighbor search, would you want to revisit the opinions you've rendered in your declaration? A. No. Q. That wouldn't change your view in
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$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to be; do I have that right? A. So I believe the patent office construction of the neighbor search is a search, right, that is, you know, is guaranteed it's a search that will identify a close but not necessarily the best neighbor, right? You know, this is, you know, consistent with my construction, right, and I believe in my declaration I have further clarified that. And I believe, so when I have a search, right, in which it's guaranteed to return a close but not necessarily the closest, all the time, right, so better than neighbor search. If I have a search in which, you know, always guaranteed to return the	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that guarantees finding an exact or the closest match in a data set qualifies as a neighbor search, would you want to revisit the opinions you've rendered in your declaration? A. No. Q. That wouldn't change your view in any way? A. No. My view is that a neighbor search or identifying a neighbor is a type of search, but, you know, does not guarantee to find the best match. The type of search that always guarantees to find the best match is not the neighbor search or identifying a neighbor. Q. And what I'm asking you is, if the patent office were to come to the conclusion
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$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ \end{array}$	Q. So what you're saying is there's no difference between your general understanding of the term "neighbor search" and what you understand the patent office construction to be; do I have that right? A. So I believe the patent office construction of the neighbor search is a search, right, that is, you know, is guaranteed it's a search that will identify a close but not necessarily the best neighbor, right? You know, this is, you know, consistent with my construction, right, and I believe in my declaration I have further clarified that. And I believe, so when I have a search, right, in which it's guaranteed to return a close but not necessarily the closest, all the time, right, so better than neighbor search. If I have a search in which, you know, always guaranteed to return the closest, okay, regardless of whether or not it returns some things that they're not the	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 MR. LUNER: Objection to form. A. Can you restate your question? Q. Sure. If the patent office were to conclude that searches, a search that guarantees finding an exact or the closest match in a data set qualifies as a neighbor search, would you want to revisit the opinions you've rendered in your declaration? A. No. Q. That wouldn't change your view in any way? A. No. My view is that a neighbor search or identifying a neighbor is a type of search, but, you know, does not guarantee to find the best match. The type of search that always guarantees to find the best match is not the neighbor search or identifying a neighbor. Q. And what I'm asking you is, if the patent office were to come to the conclusion that a search that does guarantee that it
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1	Page 90	1	Page 92
1	disclosed in the prior art?	1	A. So if the title of that reference
$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	MR. LUNER: Objection to form.	2 3	is a unique key, right, a unique identifier
3	A. The written statements are there.	3 4	of that reference, that would be a result that I didn't find.
4	So my opinion about what constitutes a	4 5	
5	neighbor search and define a neighbor was		Q. And if a search were to return a
6	reached independent of the patent office, you	6	list of titles and indicate that one of those
7	know, opinion, right. So I don't think I	7 8	titles is a match but not specify which one,
8 9	would be I will be needing to revisit, you	8 9	do you believe that search will have identified a match within the context of the
10	know, my opinion in those terms.	10	
10	Q. You understand that the patent	10	court's claim construction, the board's claim construction?
11	office is the one that ultimately decides how	11	
12	A. I believe so.		A. Can you repeat your question again?
		13	Q. Sure. If a search were to return a
14	Q. So if the patent office were to	14 15	list of titles and indicate that one of the titles in that list is a close match but not
15	reach a conclusion different from yours with		
16 17	regard to whether a search that guarantees finding an exact or the closest match	16 17	specify which one, do you believe that that
17		17	search will have identified a neighbor within
18 19	qualifies as a neighbor search, would you	18 19	the scope of the board's construction?
19 20	want to revisit the opinions in your declaration?	19 20	MR. LUNER: Objection to form.
20 21		20	A. So the result of the query is a set
21 22	A. Opinions regarding what?Q. Opinions regarding whether the	21	of records, right; and I know within that
22		22	record there is a close match, but I don't know which one it is.
23 24	prior art references you've discussed in your	23 24	Q. Correct.
24 25	declaration disclose a neighbor search. A. So if the patent office defines a	24 25	A. Right? That will not have
23	A. So if the patent office defines a	23	A. Kight: That will not have
1	Page 91	1	Page 93
$\begin{vmatrix} 1\\ 2 \end{vmatrix}$	neighbor search as a type of search that always guarantees to return the best result,	1 2	identified the close but not necessarily an exact or close match.
3		3	
3 4	right, then my opinion as far as the validity	4	Q. And if a search is run and it
4 5	of the prior art, in light of the claims as it relates to the neighbor search in light of	4 5	returned the title of the closest matching
6	v	6	reference, will that search have identified a
7	the prior art, right, will have to change.	7	neighbor within the board's construction? A. If that search within the
8	Q. Just for convenience, to have the construction in front of you, if you could		
			construction of the board identified a close
0		8	construction of the board identified a close
9 10	turn to paragraph 60 in your declaration.	9	but not necessarily an exact or closest
10	turn to paragraph 60 in your declaration. A. I have 6 here. You sure?	9 10	but not necessarily an exact or closest match, if it always returned the closest
10 11	turn to paragraph 60 in your declaration.A. I have 6 here. You sure?Q. Paragraph 60, the grid showing the	9 10 11	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that
10 11 12	turn to paragraph 60 in your declaration.A. I have 6 here. You sure?Q. Paragraph 60, the grid showing the constructions that were applied.	9 10 11 12	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close
10 11 12 13	turn to paragraph 60 in your declaration.A. I have 6 here. You sure?Q. Paragraph 60, the grid showing the constructions that were applied.A. Yes.	9 10 11 12 13	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match,
10 11 12 13 14	turn to paragraph 60 in your declaration.A. I have 6 here. You sure?Q. Paragraph 60, the grid showing the constructions that were applied.A. Yes.Q. So looking at the construction for	9 10 11 12 13 14	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match, but sort of has two implications, one
10 11 12 13 14 15	 turn to paragraph 60 in your declaration. A. I have 6 here. You sure? Q. Paragraph 60, the grid showing the constructions that were applied. A. Yes. Q. So looking at the construction for neighbor search there, it begins with 	9 10 11 12 13 14 15	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match, but sort of has two implications, one implication is that if the result you
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10 11 12 13 14 15 16 17 18	 turn to paragraph 60 in your declaration. A. I have 6 here. You sure? Q. Paragraph 60, the grid showing the constructions that were applied. A. Yes. Q. So looking at the construction for neighbor search there, it begins with identifying. Do you see that? A. Uh-huh. 	9 10 11 12 13 14 15 16 17 18	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match, but sort of has two implications, one implication is that if the result you know, I mean if the query, that's one, if the query of guarantee to return the closest, right, it's not a neighbor search.
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10 11 12 13 14 15 16 17 18 19 20 21 22	 turn to paragraph 60 in your declaration. A. I have 6 here. You sure? Q. Paragraph 60, the grid showing the constructions that were applied. A. Yes. Q. So looking at the construction for neighbor search there, it begins with identifying. Do you see that? A. Uh-huh. Q. And how do you interpret the term "identifying"? A. Finding. Q. So if a search is run and returns 	9 10 11 12 13 14 15 16 17 18 19 20 21 22	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match, but sort of has two implications, one implication is that if the result you know, I mean if the query, that's one, if the query of guarantee to return the closest, right, it's not a neighbor search. So given your question, if the query always returned the closest match, no, that will not be a neighbor search. Q. Let's move on to a different term.
10 11 12 13 14 15 16 17 18 19 20 21 22 23	 turn to paragraph 60 in your declaration. A. I have 6 here. You sure? Q. Paragraph 60, the grid showing the constructions that were applied. A. Yes. Q. So looking at the construction for neighbor search there, it begins with identifying. Do you see that? A. Uh-huh. Q. And how do you interpret the term "identifying"? A. Finding. Q. So if a search is run and returns the title of a matching reference, is it your 	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match, but sort of has two implications, one implication is that if the result you know, I mean if the query, that's one, if the query of guarantee to return the closest, right, it's not a neighbor search. So given your question, if the query always returned the closest match, no, that will not be a neighbor search. Q. Let's move on to a different term. The term "approximate nearest neighbor
10 11 12 13 14 15 16 17 18 19 20 21 22	 turn to paragraph 60 in your declaration. A. I have 6 here. You sure? Q. Paragraph 60, the grid showing the constructions that were applied. A. Yes. Q. So looking at the construction for neighbor search there, it begins with identifying. Do you see that? A. Uh-huh. Q. And how do you interpret the term "identifying"? A. Finding. Q. So if a search is run and returns 	9 10 11 12 13 14 15 16 17 18 19 20 21 22	but not necessarily an exact or closest match, if it always returned the closest match, right, it's my opinion that that particular board construction with the close but not necessarily exact or closest match, but sort of has two implications, one implication is that if the result you know, I mean if the query, that's one, if the query of guarantee to return the closest, right, it's not a neighbor search. So given your question, if the query always returned the closest match, no, that will not be a neighbor search. Q. Let's move on to a different term.

20experience with as of 2000?20Q. What sort of actions would fall21A. Yes.21within the scope of the term "action" in22Q. Now, putting aside the Cox patents22claim?23and the board's constructions in this case,23A. I presume, you know, fetching a24as of 2000, was it your understanding that an24record from a database and transmitting25Q. Anything else?1A. I cannot think of any2A. So outside the context of the3A. No.3patents, the term for approximate nearest3A. No.4neighbor search, you know, it's usually a3A. No.5sublinear algorithm, but it doesn't have to6be similar.6be similar.7Q. Take a look at Exhibit 2, that's in77Q. Take a look at column 26.9Q. And you see there that the claim9particular if you look at column 26.9Q. And you see there that the claim10A. Yes.10sesciation with the electronic work??13Tbetermining an Action"?13A. Yep.14A. Of the element do you want me to151615take a look at?19Q. The element B, right?19Q. The element B, right?19Q. So displaying additional19Q. The leement C, I'm sorry.19Q. So displaying additional20A. Element C.20202021Q. The element C, I'm sorry. <td< th=""><th></th><th></th><th></th><th></th></td<>				
2 Q. And you understand that the board 3 A. I believe so. 3 has preliminarily construed that term to mean 3 Q. Do you have an understanding of 4 identifying a close match that is not 5 occusitutes an action within the sci 6 A. Yes. 6 A. It's been a while since I looked. 7 Q. Now based on your review of the Cox. 8 see my declaration for that. 9 doesn't purport to have invented the concept 9 Okay, I've had a chance to go ov 10 of the approximate nearest neighbor 10 is, so what was your question? 11 searchas a term, right, has been used, you 14 of the term "determining an action within the sci 11 A. The approximate nearest neighbor 16 A. I believe so. 12 A. That is correct. 12 A. I believe so. 13 What constitutes an action within the sci 9 98 patent claim 15? 14 of the approximate nearest neighbor 15 A. I believe so. 15 A. The approximate nearest neighbor searching something that you had 17 Q. What is your understanding? 14 of the board's constructions in this c	1	-	1	Page 96
3 has preliminarily construed that is not 3 Q. Do you have an understanding of what constitutes an action within the science is constructions in science in the closest match? 6 A. Yes. 5 of this claim term? 7 Q. Now based on your review of the Cox 8 see my declaration for that. 9 doesn't purport to have invented the concept 6 A. It's been a while since I looked: 10 of the approximate nearest neighbor 11 Q. Okay, I've had a chance to go over it, so what was your question? 11 Q. That's a concept that was known to present ing; 11 Q. Okay, I'lask it again. 12 A. That is correct. 11 Do you have an understanding of what constitutes an action within the science? 13 Q. That's a concept that was known to present ing; 12 Do you have an understanding of what constitutes an action within the science? 14 people skilled in the field as of 2000? 15 A. The approximate nearest 15 A. The approximate nearest 15 What is your understanding? 16 people skilled in the field as of 2000? 16 A. I believe so. 17 Q. Now, putting aside the Cox patents as of 2000, was it your understanding that an approximate nearest neighbor sea				
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5 necessarily the closest match? 5 of this claim term? 6 A. Yes. 6 A. It's been a while since I looked. 7 Q. Now based on your review of the Cox. 7 7 8 patents, would you agree with me that Dr. Cox. 8 7 9 doesn't purport to have invented the concept. 9 Okay, I've had a chance to go ov. 10 searching? 11 Q. Okay, I'll ask it again. 12 A. That's a concept that was known to 13 what was your question? 13 Q. That's a concept that was known to 13 what was your question? 14 people skilled in the field as of 2000? 14 Do you have an understanding of 15 A. The approximate nearest 16 A. I believe so. 17 Romor is a term, right, has been used, you 16 A. I believe so. 18 Q. Pardon me. Is approximate nearest 98 patent claim 15? A. So determining an action or the 20 Now, yuting aside the Cox patents 22 A. I presume, you know, fetching a 23 and the board's constructions in this case, A. No. A. No. 24 <t< td=""><td></td><td></td><td></td><td></td></t<>				
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7Q. Now based on your review of the Cox B patents, would you agree with me that Dr. Cox doesn't purport to have invented the concept 0 of the approximate nearest neighbor searching?7this particular claim. I need to be able see my declaration for that.10doesn't purport to have invented the concept 10 of the approximate nearest neighbor search as a term, right, has been used, you 15A. That's a concept that was known to 13Q. Okay, Tl'a ski tagain. Do you have an understanding of what constitutes an action within the sc of the term "determining an action" in to 19 ski you nuderstanding?18A. The approximate nearest neighbor searching something that you had a so f 2000, was it your understanding that an a approximate nearest neighbor search, you know, it's usually a sublinear algorithm, but it doesn't have to b esimilar.7What is your understanding? A. No.2A. So outside the context of the sublinear algorithm, but it doesn't have to b esimilar.7A. I cannot think of any 2 (Discussion off the record.)3A. Yes.3A. No.4neighbor search, you know, it's usually a sublinear algorithm, but it doesn't have to b esimilar.4A. Yes.6Q. Take a look at 22 particular if you look at colum 15.987We're looking at claim 15 in the 199910A. Yes.9Q. And you see there that the claim 107Q. So displaying additional a claim 15 in the 199A. Yep.11A. So which element C. 10Yes1012Q. The element C. 1010<				
8 patents, would you agree with me that Dr. Cox 8 see my declaration for that. 9 doesn't purport to have invented the concept 10 CMAay, I've had a chance to go ov 11 searching? 10 it, so what was your question? 12 A. That is correct. 12 Do you have an understanding of 13 Q. That's a concept that was known to 14 of the term 'determining an action' in the sco 15 A. The approximate nearest neighbor 15 988 patent claim 15? 16 search as a term, right, has been used, you 16 A. The is your understanding? 18 Q. Pardon me. Is approximate nearest 17 Q. What sort of actions would fall 21 A. Yes. 20 Q. What sort of actions would fall 23 and the board's constructions in this case, 24 34 as of 2000, was it your understanding that an 25 3 aptents, the term for approximate nearest 3 4 neighbor search, you know, it's usually a 3 5 sto outside the context of the 3 6 be similar. 7 7 Q. Take a look at Exhibit 2,				
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11 searching? 11 Q. Okay, I'll ask it again. 12 A. That is correct. 12 Do you have an understanding of what constitutes an action within the science with as of 2000? 15 A. The approximate nearest neighbor 13 what constitutes an action within the science with as of 2000? 16 search as a term, right, has been used, you 16 A. I believe so. 17 Q. Pardon me. Is approximate nearest 18 A. So determining an action over his, you know, selecting an action to per condition and the board's constructions in this case, 20 experience with as of 2000? 20 Q. What sort of actions would fall within the scope of the term "action" in the scope of the term for approximate nearest 1 always be sublinear? 1				•
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13Q. That's a concept that was known to people skilled in the field as of 2000?13what constitutes an action within the sc of the term "determining an action" in t '988 patent claim 15?15A. The approximate nearest neighbor search as a term, right, has been used, you know, in prior to 2000, yes.15'988 patent claim 15?18Q. Pardon me. Is approximate nearest experience with as of 2000?16A. I believe so.17Q. Now, putting aside the Cox patents and the board's constructions in this case, as of 2000, was it your understanding that an 2518A. I presume, you know, fetching a record from a database and transmitting Q. Anything else?1always be sublinear?121A. I cannot think of any (Discussion off the record.)2A. So outside the context of the patents, the term for approximate nearest neighbor search, you know, it's usually a 5 sublinear algorithm, but it doesn't have to b e similar.167Q. Take a look at Exhibit 2, that's in particular if you look at column 26.710A. Yes.9Q. And you see there that the claim association with the electronic work"?13"Determining an Action"?1114A. So which element do you want me to 151515take a look at?1516Q. We're looking at claim 15 in the 191617'988 patent, and this is around line 7.1718A. Of the element B, right?1819Q. The element C, I'm sorry.1910A. Element C.1011 <td></td> <td>•</td> <td></td> <td></td>		•		
14people skilled in the field as of 2000?14of the term "determining an action" in the15A. The approximate nearest neighbor15'988 patent claim 15?16search as a term, right, has been used, you16A. I believe so.17know, in prior to 2000, yes.16A. I believe so.18Q. Pardon me. Is approximate nearest18A. So determining an action over h19neighbor searching something that you had19Q. What is your understanding?20Q. Now, putting aside the Cox patents20Q. What sort of actions would fall21A. Yes.21as of 2000, was it your understanding that an2323and the board's constructions in this case,23A. I presume, you know, fetching a24as of 2000, was it your understanding that an242425adways be sublinear?1A. I cannot think of any2A. So outside the context of the2Q. Let's go down a little bit further3neighbor search, you know, it's usually a4Q. Let's go down a little bit further4neighbor search, you know, it's usually a4Q. Let's go down a little bit further5spatent, and toix it a column 26.9Q. And you see there that he claim 31.6be similar.72A. Yes.710A. Yes.9Q. And you see there that he claim 31.11Q. Element C of claim 15 at the top of11ant/or displacing additional informatio12the				
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16search as a term, right, has been used, you know, in prior to 2000, yes.16A. I believe so.17Q. Pardon me. Is approximate nearest neighbor searching something that you had experience with as of 2000?17Q. What is your understanding?20Pardon me. Is approximate nearest neighbor searching something that you had 2118A. So determining an action over h is, you know, selecting an action to per Q. What sort of actions would fall within the scope of the term "action" in 2221A. Yes.2323and the board's constructions in this case, approximate nearest neighbor search must2324as of 2000, was it your understanding that an approximate nearest neighbor search must2325A. So outside the context of the neighbor search, you know, it's usually a sublinear algorithm, but it doesn't have to be similar.13for to f you, the '988 patent. And in 9 particular if you look at column 26.33for to f you, the '988 patent. And in 9 particular if you look at column 26.94A. So which element C of claim 15 at the top of 151116Q. We're looking at claim 15 in the1517'988 patent, and this is around line 7.1618A. Of the element C, 1'm sorry.1920Q. The element C, 1'm sorry.1921Q. The element C, 1'm sorry.1922Q. So displaying additional information2034A. Element C.2045A. Of the element B, right?1946 <t< td=""><td></td><td></td><td></td><td></td></t<>				
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Karypis

Page 101information include the title of the song2that you're searching for?3A. That can be the additionalinformation.3that trom paragraph 60 in your declaration.4Yep. Trin agreement with that5Q. Can you think of anything that you6believe would not qualify as an action, as7M.R. LUNER: Objection to form.10A. So your question, if 1 - actually11your question was, can 1 think of any type of12actions that will not fall within the scope13of this thing?14Q. Correct.15A. So an action that is not based on16the identification would not fall within the17g. Okay. Anything else come to mind?18Q. Okay. Anything else come to mind?19A. Well, an action that s not20determining action, right?21A. May ou say that because the claim22Q. And you also say that an action not23Q. And you also say that an action not24A. Yep.25Q. And you also say that an action not26Q. Focusing just on the word "action,"27M. LUNRE: Objection to form.28A. Yep.29There are 00 million entries in the example is that 920the context of the claim?21M. K.LUNRE: Objection to form.22Q. And you also say that an action not23A. Okay. I read the passage. Go24A. Y			-	
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 15 the rest of the words in this step. 16 Q. Let's move to another term. And 17 the word "sublinear" appears in some of the 18 challenge claims issued in the correct? 19 A. I believe so. 20 Q. And the board has indicated that 21 "sublinear should be construed to mean a 15 A. That's what it says, yes. 16 Q. So it's your understanding that 17 each commercial doesn't have its own entry in 18 the database, but rather the commercials are 19 A. I believe so. 20 Q. And the board has indicated that 21 "sublinear should be construed to mean a 				
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 the word "sublinear" appears in some of the challenge claims issued in the correct? A. I believe so. Q. And the board has indicated that "sublinear should be construed to mean a the database, but rather the commercials are deconstructed into their individual frames? A. So, yes, in this particular example, each frame is considered to be an 		-		
 18 challenge claims issued in the correct? 19 A. I believe so. 20 Q. And the board has indicated that 21 "sublinear should be construed to mean a 18 the database, but rather the commercials are deconstructed into their individual frames? 20 A. So, yes, in this particular 21 example, each frame is considered to be an 				
19A. I believe so.19deconstructed into their individual frames?20Q. And the board has indicated that20A. So, yes, in this particular21"sublinear should be construed to mean a21example, each frame is considered to be an				
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21 "sublinear should be construed to mean a 21 example, each frame is considered to be an				
-				
				-
 23 less than linear relationship to the size of 23 considered to be an entry in the database. 				-
1		-		-
2412412412412425A. That sounds right.2590 million?	24	The data set to be searched right /		
25 13. That sounds fight. 25 70 fillinoit:	24 25			

26 (Pages 98 - 101)

		y pro	
1	Page 102	1	Page 104
1	A. Yes.	1	Q. And if you were to organize the
2	Q. Now if we were to construct the	2	database where each commercial is a database
3	database such that each commercial was an	3	entry, what would be the merit of that
4	individual entry in the database, then N	4	approach?
5	would be 100,000?	5	A. So the merit of that approach is,
6	A. If the record is a commercial, yes,	6	with my goal at the end of the day is to
7	then it would be 100,000.	7	identify a commercial that contains my query
8	Q. Now in your view, in the example	8	frame, then I just need to identify one
9	here regarding the number of comparisons that		matching query frame to a video frame in a
10	would be required to determine whether there	10	record. So that I don't have to identify,
11	is a match among these 100,000 commercials,	11	you know, search every single one video
12	would it make a difference if the database	12	frame, you know, from the record.
13	was constructed with each database entry	13	Q. Now on line 25, there's a reference
14	being one commercial, as opposed to one	14	to a storage requirement of nine gigabytes.
15	frame?	15	What does that refer to?
16	A. Again, the question then becomes	16	A. The nine gigabytes I believe is 9
17	what is the granularity of the results,	17	million times 1,000 bytes.
18	right? If what you want to identify is a	18	Q. So is that the size of the database
19 20	frame, right, then that's the way to do it.	19	that would be required to hold all of these frames?
20	If you want to identify a commercial, right,	20	
21 22	then I would probably store each, each commercial in its own record.	21 22	A. It's not here.
22		22	Q. The proposal a couple lines above
23 24	Q. And what if your goal is to identify a commercial, using a single frame	23 24	is to take every tenth frame to construct the database from the total of 90 million,
24 25	as a query?	24	correct?
23	us u quory.	23	
1	Page 103	1	Page 105
1	A. Okay. And what is the question?	1	A. Correct.
2	A. Okay. And what is the question? My goal is what then?	2	A. Correct.Q. And the assumption is that each
2 3	A. Okay. And what is the question?My goal is what then?Q. Yes, I'm sorry. If that was your	2 3	A. Correct.Q. And the assumption is that each vector, meaning each frame, is one kilobyte,
2 3 4	A. Okay. And what is the question?My goal is what then?Q. Yes, I'm sorry. If that was your goal then then how would you construct the	2 3 4	A. Correct.Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right?
2 3 4 5	A. Okay. And what is the question?My goal is what then?Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set?	2 3 4 5	A. Correct.Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right?A. Okay.
2 3 4 5 6	A. Okay. And what is the question?My goal is what then?Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set?MR. LUNER: Objection to form.	2 3 4 5 6	A. Correct.Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right?A. Okay.Q. So that gets us to the coverage
2 3 4 5 6 7	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both 	2 3 4 5 6 7	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes?
2 3 4 5 6 7 8	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the 	2 3 4 5 6 7 8	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes.
2 3 4 5 6 7 8 9	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 	2 3 4 5 6 7 8 9	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size
2 3 4 5 6 7 8 9 10	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, 	2 3 4 5 6 7 8 9 10	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required,
2 3 4 5 6 7 8 9 10 11	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can 	2 3 4 5 6 7 8 9 10 11	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right?
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2 3 4 5 6 7 8 9 10 11 12 13 14	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are 	2 3 4 5 6 7 8 9 10 11 12 13 14	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of
2 3 4 5 6 7 8 9 10 11 12 13 14 15	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one 	2 3 4 5 6 7 8 9 10 11 12 13 14 15	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one frame from the commercial, what would be the 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction of sublinear, right? One being the number of
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one frame from the commercial, what would be the merit of organizing the database with each 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction of sublinear, right? One being the number of entries in the data set and two being the
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one frame from the commercial, what would be the merit of organizing the database with each database entry being a single frame? A. So the merit of doing something like that is, you know, going back to the whole example that you used before, one 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ \end{array}$	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction of sublinear, right? One being the number of entries in the data set and two being the size of an individual entry in the data set; is that right? A. That's correct. Q. Why isn't there a third possible
$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ \end{array}$	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one frame from the commercial, what would be the merit of organizing the database with each database entry being a single frame? A. So the merit of doing something like that is, you know, going back to the whole example that you used before, one record database, right? So if I organize it 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction of sublinear, right? One being the number of entries in the data set and two being the size of an individual entry in the data set; is that right? A. That's correct. Q. Why isn't there a third possible interpretation which would be the size on
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one frame from the commercial, what would be the merit of organizing the database with each database entry being a single frame? A. So the merit of doing something like that is, you know, going back to the whole example that you used before, one record database, right? So if I organize it this way, I could potentially develop some, 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ \end{array}$	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction of sublinear, right? One being the number of entries in the data set and two being the size of an individual entry in the data set; is that right? A. That's correct. Q. Why isn't there a third possible interpretation which would be the size on disk required for the database?
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 A. Okay. And what is the question? My goal is what then? Q. Yes, I'm sorry. If that was your goal then then how would you construct the data set? MR. LUNER: Objection to form. A. I can see merits for both approaches, so I'm really concerned with the way it was discussed over here, you know, 90,000 90 million records, one frame, which they're base records, or I can construct it as one record for each commercial. Q. Now, using my example where you are trying to identify a commercial using one frame from the commercial, what would be the merit of organizing the database with each database entry being a single frame? A. So the merit of doing something like that is, you know, going back to the whole example that you used before, one record database, right? So if I organize it 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ 23\\ \end{array}$	 A. Correct. Q. And the assumption is that each vector, meaning each frame, is one kilobyte, right? A. Okay. Q. So that gets us to the coverage requirement of 9 gigabytes? A. Yes. Q. That's a representation of the size of the database that would be required, right? A. I believe so, yeah. Q. In your declaration at paragraph 61, you list two possible interpretations of size of the data set within the construction of sublinear, right? One being the number of entries in the data set and two being the size of an individual entry in the data set; is that right? A. That's correct. Q. Why isn't there a third possible interpretation which would be the size on disk required for the database?

27 (Pages 102 - 105)

Karypis

1	Page 106 that the number of entries in the data set is	1	Page 108
1		1	Q. So you think someone with
2	the appropriate interpretation.	2	experience in text information retrieval
3	Why would the size on disk not be	3	would be able to apply that knowledge to more
4	an appropriate interpretation?	4	highly dimensional problems associated with
5	A. I think that can also be an	5	audio and video retrieval?
6	appropriate interpretation.	6	A. I do.
7	MR. NEMEC: Can we go off the	7	Q. At the end of your definition there
8	record for just a moment?	8	is reference to a related area, a graduate
9	THE VIDEOGRAPHER: The time is	9	degree in the same or related area.
10	12:09. We're going off the record.	10	What would be the related areas
1	This will be the end of disk number 2.	11	that you're referring to there?
12	(A brief recess was taken.)	12	A. So related areas would be probably
3	THE VIDEOGRAPHER: The time is	13	electrical engineering, possibly statistics.
4	12:20. We're back on the record. This	14	(Discussion off the record.)
15	is the beginning of disk number 3.	15	A. Statistics.
16	Q. Dr. Karypis, I would like to direct	16	Q. If the level of skill in the art
17	you to paragraph 11 in your declaration.	17	was determined to be higher or lower than
18	A. Yes.	18	what you've described here in your
19	Q. In paragraph 11 you state your	19	declaration, do you believe that would impact
20	opinion on the qualifications of a person of	20	any of the opinions you've expressed?
20	ordinary skill in the art of the inventions	20	A. I do not think so.
22	•	21 22	MR. NEMEC: Mark as Exhibit 6 a
	at issue in this case; is that right?		
23	A. That's correct.	23	document, a 13-page document that says
	Q. Now, is it your view that there is	24	"Big O notation" at the top.
	any material difference between your	24 25	(Karypis Exhibit 6, Wikipedia entry
25	any material difference between your Page 107	25	(Karypis Exhibit 6, Wikipedia entry Page 109
25 1	any material difference between your Page 107 definition of the level of skill in the art	25 1	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for
25 1 2	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's?	25 1 2	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.)
25 1 2 3	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's? A. In my view, I don't think there's a	25 1	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.) Q. Do you have Exhibit 6 before you?
25 1 2 3 4	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's?	25 1 2 3 4	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.)
25 1 2 3	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's? A. In my view, I don't think there's a	25 1 2 3	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.) Q. Do you have Exhibit 6 before you?
25 1 2 3 4	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's? A. In my view, I don't think there's a material difference. I think there is a	25 1 2 3 4	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.) Q. Do you have Exhibit 6 before you? A. I do.
25 1 2 3 4 5	Page 107 Page 107 definition of the level of skill in the art and Dr. Moulin's? A. In my view, I don't think there's a material difference. I think there is a difference in terms of the degree requirements, but I think once you've had	25 1 2 3 4 5	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.) Q. Do you have Exhibit 6 before you? A. I do. Q. Is this a document that you
25 1 2 3 4 5 6 7	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's? A. In my view, I don't think there's a material difference. I think there is a difference in terms of the degree	25 1 2 3 4 5 6 7	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.) Q. Do you have Exhibit 6 before you? A. I do. Q. Is this a document that you reference and rely upon in your declaration? A. I believe so.
25 1 2 3 4 5 6 7 8	any material difference between your Page 107 definition of the level of skill in the art and Dr. Moulin's? A. In my view, I don't think there's a material difference. I think there is a difference in terms of the degree requirements, but I think once you've had your degree and experience, it all comes out to about the same.	25 1 2 3 4 5 6 7 8	(Karypis Exhibit 6, Wikipedia entry Page 109 entitled, "Big O notation," marked for identification, this date.) Q. Do you have Exhibit 6 before you? A. I do. Q. Is this a document that you reference and rely upon in your declaration? A. I believe so. Q. And this is a printout from
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Page 111	
e e e e e e e e e e e e e e e e e e e	Page 113
1 THE WITNESS: Sounds good. 1 use of relative pitch values from a quer	
2 THE VIDEOGRAPHER: The time is 2 compare those to pitch values of known	
3 12:28. We're going off the record. 3 references to look for a match or a near	
4 (Lunch recess taken at 12:28 p.m.) 4 match; is that a fair characterization?	
5 A. Yes. That's one of the ways, ye	
6 Q. One of the things that's describe	
7 in the Iwamura reference is a note-by-n	
8 8 comparison process as between a query	work
9 9 and a reference work, correct?	
10 10 A. Basically, yes.	
11 Q. Would you generally explain yo	
12 understanding of how that note-by-note	
13 13 comparison process works, as described	1n
14 14 Iwamura?	
15 A. My recollection of the particular	
16 16 algorithm or approach, something like t	nat,
17 so I have a query which is for a certain	
18 18 length; and I have a reference melody t	iat's
19 for a certain length. And then I start at	1.7
20 20 the beginning of the reference melody a	
21 21 compute a distance, you know, between	
22 what is called data points of the query t	
23 23 the data point in the reference. That we	
1	
2325and boild in the reference. That we2424give me some score of distance, I believ2525And then I, you know, shift the	ve.

29 (Pages 110 - 113)

		JP ¹⁰	
1	Page 114 query by one to the right, and I repeat the	1	Page 116 purposes, right?
2	process and keep on doing that until the end.	2	A. Yes.
3	And at the end I return the score of the	3	Q. So I would be correct in assuming,
4	match, the best scoring subsegment or the	4	wouldn't I, that you believe these are
5	highest scoring subsegment.	5	accurate representations of what a query work
6	Q. The highest or the lowest scorings?	6	might look like, according to Iwamura?
7	A. I believe they're using distance.	7	A. Uh-huh.
8	That would be the lowest.	8	Q. Or what a reference work might look
9	Q. Now, if we assume hypothetically	9	like?
10	that a query is a string, $5, 4, 3, 2, 1$, is	10	A. That is correct.
11	that a fair representation of a query that we	11	Q. But you're not certain one way or
12			
	might use in the Iwamura note-by-note search?		the other whether the centering you described
13	A. I believe so, yes. Those would be	13	is required?
14	relative pitches, yes.	14	A. I don't recall the specific method
15	Q. So let's assume our query is 5, 4,	15	that they use, but the fact that they have,
16	3, 2, 1, and let's assume we're going to	16	you know, both positive and negatives that
17	compare that to a reference work that has the $(5, 5, 4, 2, 2, 1)$	17	measures a high and a low relative to a
18	sequence 6, 5, 4, 3, 2, 1.	18	baseline, so that's where the negative values
19	Is that a reasonable assumption to	19	comes in.
20	make, according to Iwamura?	20	Q. Now, so let's assume for purposes
21	A. Say that again?	21	of this hypothetical that the centering is
22	Q. Can we assume that 6, 5, 4, 3, 2, 1	22	not required.
23	would be a valid representation of a	23	So in the hypothetical that I'm
24	reference work, according to Iwamura?	24	describing the query is 5, 4, 3, 2, 1, okay?
25	A. You need to check whether or not	25	A. Okay.
	Page 115		Page 117
1	the references are centered, which has to do		
		1	Q. And the reference work that we're
2	with whether or not it will have present	2	comparing it to is 6, 5, 4, 3, 2, 1, okay?
3	with whether or not it will have present negative values or not.		comparing it to is 6, 5, 4, 3, 2, 1, okay? A. Okay.
3 4	with whether or not it will have present negative values or not. Q. Whether they will have I'm	2 3 4	comparing it to is 6, 5, 4, 3, 2, 1, okay?A. Okay.Q. So when we begin the note-by-note
3 4 5	with whether or not it will have present negative values or not. Q. Whether they will have I'm sorry?	2 3	comparing it to is 6, 5, 4, 3, 2, 1, okay?A. Okay.Q. So when we begin the note-by-note comparison between this query and this
3 4 5 6	with whether or not it will have present negative values or not.Q. Whether they will have I'm sorry?A. Whether there would be negative	2 3 4	comparing it to is 6, 5, 4, 3, 2, 1, okay?A. Okay.Q. So when we begin the note-by-note comparison between this query and this reference work, how do we align the pieces or
3 4 5 6 7	with whether or not it will have present negative values or not.Q. Whether they will have I'm sorry?A. Whether there would be negative values present in the sequence or not. I	2 3 4 5 6 7	comparing it to is 6, 5, 4, 3, 2, 1, okay?A. Okay.Q. So when we begin the note-by-note comparison between this query and this reference work, how do we align the pieces or the strings for the first comparison?
3 4 5 6 7 8	with whether or not it will have present negative values or not.Q. Whether they will have I'm sorry?A. Whether there would be negative values present in the sequence or not. I believe, you know, both actually, the query	2 3 4 5 6	comparing it to is 6, 5, 4, 3, 2, 1, okay?A. Okay.Q. So when we begin the note-by-note comparison between this query and this reference work, how do we align the pieces or
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3 4 5 6 7 8	 with whether or not it will have present negative values or not. Q. Whether they will have I'm sorry? A. Whether there would be negative values present in the sequence or not. I believe, you know, both actually, the query and the reference, those are relative pitch differences, so and I don't recall if they center those things or not. Q. What do you mean by "center"? A. For example, subtract the mean value out of the values. Q. Okay. So you're not sure whether any given query or reference string would have to have some negative numbers in it? A. Correct. Q. Now, you have a couple of examples of strings in your declaration, and we can check those to get the answer. 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 comparing it to is 6, 5, 4, 3, 2, 1, okay? A. Okay. Q. So when we begin the note-by-note comparison between this query and this reference work, how do we align the pieces or the strings for the first comparison? MR. LUNER: Objection to form. A. So I believe Iwamura disclosed a couple of methods. One is one that does initial alignments by computing the scores by relying on the peaks, and I also believe they disclosed an early, less sophisticated method that, you know, they start from the beginning to align with things. Q. Okay. And is the less sophisticated method that you are describing the note-by-note comparison? A. I believe so, yes. Q. So that's the one that I'm asking about at this point now.

		J P 10	
	Page 118		Page 120
1	A. So the first position of the query	1	in the Iwamura patent, in particular the text
2	will align against the first position of the	2	that begins around 20 and continues down to
3	reference and so forth.	3	around 45. If you want to take a moment to
4	Q. So for example, the 5 would align	4	look at that and, I will ask my question.
5	with the 6, and 4 would align with 5 and so	5	A. Sure.
6	forth?	6	So you are saying up to line 35,
7	A. Correct.	7	right?
8	Q. And then in the note-by-note	8	Q. Around to 45, after that second
9	process, after that first set of comparisons	9	equation.
10	is made, the query work would be shifted to	10	A. Okay.
11	the right; is that correct?	11	Q. The text you just reviewed in
12	A. The query would be shifted to the	12	column 7 of Iwamura relates to the peak
13	right by one, correct.	13	search process, correct?
14	Q. So in the second position, then,	14	A. That is correct.
15	the 5 would align with the 5?	15	Q. And what we see depicted in the
16	A. I don't think that's, so if the	16	first equation there from about line 26
17	query is 6, 5, 4, 3, 2, 1, right?	17	through 30 is a comparison of a database
18	Q. The query in my hypothetical was 5,	18	reference in the top line, correct?
19	4, 3, 2, 1, and the reference was 6, 5, 4, 3,	19	A. Well, the top line actually has
20	2, 1?	20	part of the database reference.
20	A. Yes, so the first 5 with the query	20	Q. Part of the database reference
$21 \\ 22$	will align with the second location of the	$\frac{21}{22}$	being compared to all or part of a query in
23	reference.	23	the second line, correct?
23	Q. And then the 6 in that instance	23	A. That is correct.
24	wouldn't be considered, because it does not	24	
23	wouldn't be considered, because it does not	23	Q. And in this particular depiction
	Page 119		Page 121
1	align with a note in the query?	1	what we see is the first peak in the query
2	align with a note in the query? A. No, correct. It would not make	2	what we see is the first peak in the query being compared to the first peak in this
2 3	align with a note in the query?A. No, correct. It would not make that comparison.	2 3	what we see is the first peak in the query being compared to the first peak in this section of the database reference, right?
2 3 4	align with a note in the query?A. No, correct. It would not make that comparison.Q. Now you just referenced a few	2 3 4	what we see is the first peak in the querybeing compared to the first peak in thissection of the database reference, right?A. I believe so, yes.
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2 3 4	align with a note in the query?A. No, correct. It would not make that comparison.Q. Now you just referenced a few moments ago the peak search approach that's described in Iwamura, correct?	2 3 4 5 6	what we see is the first peak in the query being compared to the first peak in this section of the database reference, right?A. I believe so, yes.Q. And then the text here in the second figure describes that in the next
2 3 4 5 6 7	align with a note in the query?A. No, correct. It would not make that comparison.Q. Now you just referenced a few moments ago the peak search approach that's described in Iwamura, correct?A. Correct.	2 3 4 5 6 7	what we see is the first peak in the query being compared to the first peak in this section of the database reference, right?A. I believe so, yes.Q. And then the text here in the second figure describes that in the next comparison, the query is shifted such that
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2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 align with a note in the query? A. No, correct. It would not make that comparison. Q. Now you just referenced a few moments ago the peak search approach that's described in Iwamura, correct? A. Correct. Q. Now, as compared to the note-by-note search, would a peak search of a given query against a given reference require fewer comparisons? A. The peak-based approach would require fewer comparisons than the note by note. Q. And turning back to the note-by-note comparison process, if you had a five-note query in the note-by-note comparison process compare that five-note query to every set of five consecutive notes in the reference? A. In the quote/unquote naive note-by-note approach, the query would 	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ \end{array}$	 what we see is the first peak in the query being compared to the first peak in this section of the database reference, right? A. I believe so, yes. Q. And then the text here in the second figure describes that in the next comparison, the query is shifted such that the first peak in the query is compared to the second peak in the database reference, correct? A. Right. Q. And that's consistent with what you testified to earlier about the peak reference, that the query is shifted with respect to the reference? A. So the query shifted with the reference, using the peaks as the anchor points to determine the amount of shift. Q. Now, in contrast, in the examples that you use in your declaration, if you take a look back to paragraph 162, for example, in these examples that you use, you depict a
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 align with a note in the query? A. No, correct. It would not make that comparison. Q. Now you just referenced a few moments ago the peak search approach that's described in Iwamura, correct? A. Correct. Q. Now, as compared to the note-by-note search, would a peak search of a given query against a given reference require fewer comparisons? A. The peak-based approach would require fewer comparisons than the note by note. Q. And turning back to the note-by-note comparison process, if you had a five-note query in the note-by-note comparison process compare that five-note query to every set of five consecutive notes in the reference? A. In the quote/unquote naive 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 what we see is the first peak in the query being compared to the first peak in this section of the database reference, right? A. I believe so, yes. Q. And then the text here in the second figure describes that in the next comparison, the query is shifted such that the first peak in the query is compared to the second peak in the database reference, correct? A. Right. Q. And that's consistent with what you testified to earlier about the peak reference, that the query is shifted with respect to the reference? A. So the query shifted with the reference, using the peaks as the anchor points to determine the amount of shift. Q. Now, in contrast, in the examples that you use in your declaration, if you take a look back to paragraph 162, for example, in these examples that you use, you depict a record being shifted with respect to the
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 align with a note in the query? A. No, correct. It would not make that comparison. Q. Now you just referenced a few moments ago the peak search approach that's described in Iwamura, correct? A. Correct. Q. Now, as compared to the note-by-note search, would a peak search of a given query against a given reference require fewer comparisons? A. The peak-based approach would require fewer comparisons than the note by note. Q. And turning back to the note-by-note comparison process, if you had a five-note query in the note-by-note comparison process compare that five-note query to every set of five consecutive notes in the reference? A. In the quote/unquote naive note-by-note approach, the query would compare to every set of five consecutive 	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 what we see is the first peak in the query being compared to the first peak in this section of the database reference, right? A. I believe so, yes. Q. And then the text here in the second figure describes that in the next comparison, the query is shifted such that the first peak in the query is compared to the second peak in the database reference, correct? A. Right. Q. And that's consistent with what you testified to earlier about the peak reference, that the query is shifted with respect to the reference? A. So the query shifted with the reference, using the peaks as the anchor points to determine the amount of shift. Q. Now, in contrast, in the examples that you use in your declaration, if you take a look back to paragraph 162, for example, in these examples that you use, you depict a

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		<i>.</i>	
	Page 122		Page 124
1	I don't think so. I believe the	1	declaration, or 101 of 292, whichever you
2	figure at the bottom of page 98 does, you	2	prefer?
3	know, imply a shift.	3	A. Yes.
4	Right, those two things should be	4	Q. Okay. So in your view that's a
5	named the other way around.	5	proper example of a query that might be run
6	Q. So that was a mistake in these	6	using the Iwamura system?
7	depictions of how Iwamura operates in your	7	A. It's a query.
8	declaration?	8	Q. And below that where it says
9	A. Yeah, it's just the label of the	9	"Reference," do you recognize that string of
10	first row should be that of the second.	10	numbers as the same string of numbers that
11	Q. Do you know if there is any	11	you used as the record in the database, in
12	disclosure in Iwamura of shifting the	12	your example in paragraph 160 of your report?
13	database reference with respect to the query?	13	A. Yes.
14	A. I don't recall.	14	Q. Now take a look at the chart that
15	Q. In paragraph 162 up above the	15	appears down below.
16	figure we were just discussing, the	16	Do you see that reference sequence
17	description of the shifting process is, in	17	in the bottom line of the grid?
18	fact, consistent with the mistakenly placed	18	A. Yes.
19	arrow, is it not?	19	Q. And do you see in comparison number
20	A. Let me read that.	20	11 in that row the query appears?
21	Actually, that statement over	21	A. Yes, I do.
22	there, it's not really clear which one is	22	Q. And do you see that in each of the
23	shifting.	23	comparison numbers 1 through 20 depicted in
24	Q. Did you write this portion of your	24	the grid, that the query is shifted by what,
25	declaration?	25	one note with respect to the reference?
1	Page 123	1	Page 125
1	A. I did.	1	A. Yes.
2	Q. Did you write all of your	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	Q. Based on your understanding of the
3	declaration?	3	note-by-note comparison process described in
4	A. I did the, wrote the first draft of	4	Iwamura, which of the comparisons in this
5	the declaration; then, you know, I got some	5	grid, if any, would take place in the
6	language edits from, from counsel. MR. NEMEC: Mark as the next	6	note-by-note comparison process?
7		7	A. So my recollection of the
8	exhibit, Karypis Deposition Exhibit 8, a	8 9	note-by-note comparison process.
9			So my understanding of the
10	single-page chart.		So my understanding of the
	(Karypis Exhibit 8, Single-page	10	note-by-note process that's described in
11	(Karypis Exhibit 8, Single-page chart, marked for identification, this	10 11	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20
11 12	(Karypis Exhibit 8, Single-page chart, marked for identification, this date.)	10 11 12	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1
11 12 13	(Karypis Exhibit 8, Single-page chart, marked for identification, this date.)Q. Dr. Karypis, I've put this together	10 11 12 13	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here.
11 12 13 14	(Karypis Exhibit 8, Single-page chart, marked for identification, this date.)Q. Dr. Karypis, I've put this together to try to make the next set of questions that	10 11 12 13 14	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same
11 12 13 14 15	(Karypis Exhibit 8, Single-page chart, marked for identification, this date.)Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to	10 11 12 13 14 15	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note
11 12 13 14 15 16	(Karypis Exhibit 8, Single-page chart, marked for identification, this date.)Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to	10 11 12 13 14 15 16	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search.
11 12 13 14 15 16 17	(Karypis Exhibit 8, Single-page chart, marked for identification, this date.)Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers.	10 11 12 13 14 15 16 17	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query
11 12 13 14 15 16 17 18	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it 	10 11 12 13 14 15 16 17 18	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak
11 12 13 14 15 16 17 18 19	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it says "Query." 	10 11 12 13 14 15 16 17 18 19	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak note search of Iwamura, which, if any, of the
11 12 13 14 15 16 17 18 19 20	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it says "Query." Do you see that string of numbers? 	10 11 12 13 14 15 16 17 18 19 20	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak note search of Iwamura, which, if any, of the comparisons 1 through 20 would take place?
11 12 13 14 15 16 17 18 19 20 21	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it says "Query." Do you see that string of numbers? A. Yes. 	10 11 12 13 14 15 16 17 18 19 20 21	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak note search of Iwamura, which, if any, of the comparisons 1 through 20 would take place? A. So my understanding of Iwamura, so
11 12 13 14 15 16 17 18 19 20 21 22	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it says "Query." Do you see that string of numbers? A. Yes. Q. Can you just take a look and 	10 11 12 13 14 15 16 17 18 19 20 21 22	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak note search of Iwamura, which, if any, of the comparisons 1 through 20 would take place? A. So my understanding of Iwamura, so the comparison that would take place that
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it says "Query." Do you see that string of numbers? A. Yes. Q. Can you just take a look and confirm that that's the same string of 	10 11 12 13 14 15 16 17 18 19 20 21 22 23	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak note search of Iwamura, which, if any, of the comparisons 1 through 20 would take place? A. So my understanding of Iwamura, so the comparison that would take place that would be first number 13. And it would be
11 12 13 14 15 16 17 18 19 20 21 22	 (Karypis Exhibit 8, Single-page chart, marked for identification, this date.) Q. Dr. Karypis, I've put this together to try to make the next set of questions that I want to walk through a little easier to understand, rather than asking you to memorize long strings of numbers. Take a look at the top where it says "Query." Do you see that string of numbers? A. Yes. Q. Can you just take a look and 	10 11 12 13 14 15 16 17 18 19 20 21 22	note-by-note process that's described in Iwamura, that would be a comparison 11 to 20 but I can easily see that also comparisons 1 through 10 would also be included here. Q. All right. Now, I ask you the same question but with respect to the peak note search. If you were comparing this query work to this reference work using the peak note search of Iwamura, which, if any, of the comparisons 1 through 20 would take place? A. So my understanding of Iwamura, so the comparison that would take place that

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1	Page 126		Page 128
1	restriction on the distance between peak	1	A. So the way a peak is defined has to
2	notes?	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	be a local minimum or local maximum, which by
3	A. I don't recall off the top of my	3	construction would have a minimum distance
4	head. If there is any restrictions on the	4	required.
5	distance between the peak notes. I can take	5	Q. What would that minimum be?
6	a look.	6	A. I believe it would be at least one
7	Q. Sure, I will have you take a look,	7	or two notes.
8	but before you do that, sir, let me ask	8	MR. NEMEC: Go ahead and mark
9	another question.	9	another chart as Exhibit 9.
10	Would distance between the peak	10	(Karypis Exhibit 9, Single-page
11	notes in either a query or a reference item	11	chart, marked for identification, this
12	in Iwamura would be a function of the music,	12	date.)
13	right?	13	Q. Do you have Exhibit 9, Dr. Karypis?
14	A. The distance between the peak notes	14	A. Yes.
15	in either the query or the reference would be	15	Q. At the top of the page it says,
16 17	a function of the music and a function of how	16	"Query * 5, 4, 3, 2, 1," do you see that?
17	they're, whether or not they're, how they're	17	Can you accept, for purposes of
18	doing the centering.	18	this hypothetical, that that's a query
19	Q. Okay. So let's take that as	19	string, according to Iwamura?
20 21	two pieces, then.	20	A. So the one part that I need to
21 22	First, can you look at Iwamura and	21 22	double check is whether or not their peak identification algorithm will allow a peak at
22 23	confirm whether or not Iwamura requires centering?		- · ·
23 24	A. Sure.	23 24	the beginning of the string or at the end of the string, as a result of their peak
24 25	So I describe both the case in	24	identification approach.
23	50 T deserve both the case in	23	dentification approach.
1	Page 127	1	Page 129
1	which, excuse me, they have both absolute	$\begin{vmatrix} 1 \\ 2 \end{vmatrix}$	Q. If you look back at paragraph 160
2	peaks as well as relative peaks data, and I	$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	in your declaration, page 101 of 292, the
3	don't believe they describe how to get the	4	sample query work that you use there begins
4	relative pitch data, so it's both scenarios.	5	with peak, correct?
5	Q. So they describe scenarios that		A. Yes, it does.
		6	O So at least when you prepared this
6	would involve centering and not involve	6	Q. So at least when you prepared this
7	centering; is that what you're saying?	7	example you believed that a query string,
7 8	centering; is that what you're saying? A. It's a relative versus an absolute,	7 8	example you believed that a query string, according to Iwamura, could begin with a
7 8 9	centering; is that what you're saying?A. It's a relative versus an absolute, yes.	7 8 9	example you believed that a query string, according to Iwamura, could begin with a peak?
7 8 9 10	centering; is that what you're saying?A. It's a relative versus an absolute,yes.Q. Okay. And then the second half of	7 8 9 10	example you believed that a query string, according to Iwamura, could begin with a peak?A. It would seem that way, so I'm just
7 8 9 10 11	centering; is that what you're saying?A. It's a relative versus an absolute,yes.Q. Okay. And then the second half of the question is: Is there anything in the	7 8 9 10 11	example you believed that a query string, according to Iwamura, could begin with a peak?A. It would seem that way, so I'm just trying to verify that.
7 8 9 10 11 12	centering; is that what you're saying?A. It's a relative versus an absolute,yes.Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some	7 8 9 10 11 12	example you believed that a query string, according to Iwamura, could begin with a peak?A. It would seem that way, so I'm just trying to verify that.Q. If we assume that that is an
7 8 9 10 11 12 13	centering; is that what you're saying?A. It's a relative versus an absolute,yes.Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the	7 8 9 10 11 12 13	example you believed that a query string, according to Iwamura, could begin with a peak?A. It would seem that way, so I'm just trying to verify that.Q. If we assume that that is an admissible way to begin a query, then can you
7 8 9 10 11 12 13 14	centering; is that what you're saying?A. It's a relative versus an absolute,yes.Q. Okay. And then the second half ofthe question is: Is there anything in theIwamura disclosure that would place somelimit on the number of notes between thepeak between the peaks?	7 8 9 10 11 12 13 14	example you believed that a query string, according to Iwamura, could begin with a peak?A. It would seem that way, so I'm just trying to verify that.Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is
7 8 9 10 11 12 13 14 15	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method 	7 8 9 10 11 12 13 14 15	example you believed that a query string, according to Iwamura, could begin with a peak?A. It would seem that way, so I'm just trying to verify that.Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura?
7 8 9 10 11 12 13 14 15 16	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no 	7 8 9 10 11 12 13 14 15 16	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form.
7 8 9 10 11 12 13 14 15 16 17	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance 	7 8 9 10 11 12 13 14 15 16 17	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start
7 8 9 10 11 12 13 14 15 16 17 18	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance between two successful peaks. 	7 8 9 10 11 12 13 14 15 16 17 18	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start the query, then so with a peak note, yes,
7 8 9 10 11 12 13 14 15 16 17 18 19	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance between two successful peaks. Q. And would that be true of both 	7 8 9 10 11 12 13 14 15 16 17 18 19	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start the query, then so with a peak note, yes, that would an appropriate query.
7 8 9 10 11 12 13 14 15 16 17 18 19 20	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance between two successful peaks. Q. And would that be true of both query and the reference? 	7 8 9 10 11 12 13 14 15 16 17 18 19 20	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start the query, then so with a peak note, yes, that would an appropriate query. Q. And if you look down at the
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance between two successful peaks. Q. And would that be true of both query and the reference? A. I believe so. 	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start the query, then so with a peak note, yes, that would an appropriate query. Q. And if you look down at the reference, do you see the string of numbers?
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance between two successful peaks. Q. And would that be true of both query and the reference? A. I believe so. Q. And just to make sure we're clear 	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start the query, then so with a peak note, yes, that would an appropriate query. Q. And if you look down at the reference, do you see the string of numbers? A. I do.
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 centering; is that what you're saying? A. It's a relative versus an absolute, yes. Q. Okay. And then the second half of the question is: Is there anything in the Iwamura disclosure that would place some limit on the number of notes between the peak between the peaks? A. So my understanding of the method they used to identify peaks, there is no limitation in terms of what, the distance between two successful peaks. Q. And would that be true of both query and the reference? A. I believe so. Q. And just to make sure we're clear on this, Iwamura also doesn't set a minimum 	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	 example you believed that a query string, according to Iwamura, could begin with a peak? A. It would seem that way, so I'm just trying to verify that. Q. If we assume that that is an admissible way to begin a query, then can you accept that this query of * 5, 4, 3, 2, 1 is an appropriate theory, according to Iwamura? MR. LUNER: Objection to form. A. Is it an appropriate way to start the query, then so with a peak note, yes, that would an appropriate query. Q. And if you look down at the reference, do you see the string of numbers? A. I do. Q. And if we again assume that it's
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1	Page 130	1	Page 132 difference between 4 and 2?
$\begin{vmatrix} 1\\ 2 \end{vmatrix}$	you accept, for purposes of this hypothetical, using that string as a	2	A. I believe so.
$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	reference?	3	Q. And so forth until you're at the
4	A. Under all of the above ifs, yes, I	4	end of the query?
5	do.	5	A. Uh-huh.
6	Q. And if our assumption about the	6	Q. Do you agree that if you were to
7	ability to start a string with a peak is	7	perform that comparison and add up the
8	incorrect, then the examples in your	8	numbers it would total 5?
9	declaration are also incorrect, right?	9	A. Yes.
10	A. The particular query that I used in	10	Q. And that's the total absolute
11	my declaration would be incorrect.	11	difference that Iwamura uses to determine
12	Q. And looking at the sample query on	12	whether a reference is a match to a query or
13	Exhibit 9, how many peaks does that query	13	not
14	have?	14	A. Yes.
15	A. Probably one.	15	Q is that correct? Okay.
16	Q. And which one is that?	16	So in the peak-by-peak pardon
17	A. That would be the one marked with a	17	me, in the peak search process, comparisons
18	star or a 5.	18	number 1 through 4 in Exhibit 9 wouldn't take
19	Q. And how many peaks does the	19	place, correct?
20	reference have?	20	A. That would be correct.
21	A. That would be two.	21	Q. And comparisons 6 through 10 would
22	Q. Which ones are those?	22	not take place, correct?
23	A. That would be 6 and 6.	23	A. That would be correct.
24	Q. Okay. Look down at the grid	24	Q. And comparisons 12 through 16 would
25	depicted below. Do you see the reference	25	not take place?
	Page 131		Page 133
1	string in green at the bottom of the grid?	1	A. That would be correct.
2	A. I do.	2	Q. And using this example query and
3	Q. And do you see the query grid	3	reference, would Iwamura make any comparison
4	depicted in various, the comparison number	4	that takes into account the one digit, digits
5	rows up above?	5	in the reference sample?
6	A. I do.	6	MR. LUNER: Objection to form.
7	Q. We were using the peak search	7	A. So your question was whether or not
8	comparison process of Iwamura, which, if any,	8	the notes marked with 1 would ever be
9	of the comparisons 1 through 16 would take	9	compared?
10	place?	10	Q. The question is whether the note in
11	A. That would be comparison number 5,	11	the string that reads 622,221,654321, were
12	and that would be comparison number 11.	12	the ones
13	Q. The second one you said was?	13	MR. NEMEC: Strike that.
14	A. 11.	14	Q. In the reference string reading
15	Q. Now, during each comparison, what	15	622,221, will that 1 ever be compared to a
16	computation does Iwamura perform?	16	note in the query?
17	A. It computes the pairwise distance	17	MR. LUNER: Objection to form.
18	between the aligned positions, so the	18	A. I'm sorry, the question is whether
19	pairwise difference, absolute difference.	19	or not that one in the query could be
20 21	Q. So using, for example, the	20	compared to a note in the reference?
1 7 1	comparison between line 5 and the reference,	21 22	Q. Correct.
	1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ -1 $+$ $+$ -1 $+$ $+$ -1 $+$ $+$ -1 $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	111	MR. NEMEC: No, strike that.
22	you would first take the difference between 5		
22 23	and 6; is that right?	23	Q. The question is whether the 1 in
22	-		

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		J P - 5	
	Page 134		Page 136
1	search according to Iwamura.	1	passing description of those from column 9,
2	A. Uh-huh.	2	lines 48 to 50, that indicate that those are
3	So the 1 in the reference would not	3	geologic send, user defined.
4	be compared to any note in the query.	4	Q. So Iwamura doesn't provide any
5	Q. If you take a look at comparison	5	objective criteria for defining what would be
6	number 12	6	an unimportant portion of the music sample,
7	A. Uh-huh.	7	correct?
8	Q and compare the alignment of the	8	A. My recollection of the disclosure,
9	query to the notes in the reference work, at	9	yes, that's correct.
10	that point, would you agree that the total absolute difference sums to zero?	10 11	Q. That would be determined at the
11 12	A. I do.	11	discretion of the person who is creating the reference database?
		12	
13 14	Q. And is that representative of an		A. It's not actually clear. I mean
14 15	exact match between the query and that portion of reference work?	14 15	what the specifications disclose, it usually identifies such important portions, that's
	A. That is representative of an exact	15	key word. The other unimportant portions
16 17	*	10	cannot be ignored. What is not clear over
17	match, yes.	17	here is who is the user.
18 19	Q. And in the peak-by-peak search process of the Iwamura, this comparison would	10	Q. Does the Iwamura reference require
19 20	not take place, correct?	20	that the query represent an important portion
20	MR. LUNER: Objection to form.	20	of a music work?
21	A. My understanding of how the	$\frac{21}{22}$	A. Can you repeat your question.
22	peak-by-peak approach of Iwamura works, that	23	Q. Do the teachings of Iwamura require
23	comparison will not be performed.	24	that the query represent an important portion
25	(Discussion off the record.)	25	of the musical work?
1	Page 135	1	Page 137
1	A. My recollection or understanding of	1	A. I don't think the Iwamura, you
2	A. My recollection or understanding of how the peak-by-peak search approach works in	2	A. I don't think the Iwamura, you know, have not had a requirement one way or
2 3	A. My recollection or understanding of how the peak-by-peak search approach works in Iwamura, that comparison will not be	2 3	A. I don't think the Iwamura, you know, have not had a requirement one way or the other.
2 3 4	A. My recollection or understanding of how the peak-by-peak search approach works in Iwamura, that comparison will not be performed.	2 3 4	A. I don't think the Iwamura, you know, have not had a requirement one way or the other.Q. So if the reference database in
2 3 4 5	A. My recollection or understanding of how the peak-by-peak search approach works in Iwamura, that comparison will not be performed.Q. So in that case Iwamura will not	2 3 4 5	A. I don't think the Iwamura, you know, have not had a requirement one way or the other.Q. So if the reference database in Iwamura were constructed to omit the
2 3 4 5 6	 A. My recollection or understanding of how the peak-by-peak search approach works in Iwamura, that comparison will not be performed. Q. So in that case Iwamura will not necessarily find the best matching melody 	2 3 4 5 6	A. I don't think the Iwamura, you know, have not had a requirement one way or the other.Q. So if the reference database in Iwamura were constructed to omit the unimportant portions of the references, and
2 3 4 5 6 7	A. My recollection or understanding of how the peak-by-peak search approach works in Iwamura, that comparison will not be performed.Q. So in that case Iwamura will not necessarily find the best matching melody segment in the reference; is that correct?	2 3 4 5 6 7	A. I don't think the Iwamura, you know, have not had a requirement one way or the other.Q. So if the reference database in Iwamura were constructed to omit the unimportant portions of the references, and the user constructed a query based on one of
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2 3 4 5 6 7 8 9 10	 A. My recollection or understanding of how the peak-by-peak search approach works in Iwamura, that comparison will not be performed. Q. So in that case Iwamura will not necessarily find the best matching melody segment in the reference; is that correct? A. So in that case, you know, Iwamura will not find the best matching segment in the melody that has the peak notes aligned. 	2 3 4 5 6 7 8 9 10	 A. I don't think the Iwamura, you know, have not had a requirement one way or the other. Q. So if the reference database in Iwamura were constructed to omit the unimportant portions of the references, and the user constructed a query based on one of those unimportant portions of the music, the search wouldn't result in a match, correct? A. So if the database does not have
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1	Page 138	1	Page 140
1	the important portions from the melody from	1	A. I believe that particular part,
2	the reference work, and the query contains	2	right, it actually refers to both the, there
3	just the unimportant part?	3	are two components in the Iwamura search that
4	Q. Correct.	4	allows you to skip, right? One has to do
5	A. Iwamura will still identify a	5	with skip of, I believe they call them
6	match. It would identify the best match that	6	repeated patterns, so repeating melodies, and
7	the user's query matches against the	7	the other one is skipping the unimportant
8	database	8	parts. So both of those things I believe
9	Q. So in that case	9	they are tied together within the same
10	A and as determined by the peaks.	10	context, and my understanding of this section
11	Q. In that case, it may return a match	11	on column 12, that essentially talks about
12	but not the closest or an exact match?	12	the whole process of unmarking, because I
13	MR. LUNER: Objection to form.	13	believe they use a term unmarking, you know,
14	A. In that case we will return a match	14	when they were describing those, those
15	that is the closest, given the data that the	15	approaches.
16	algorithm searches and how it performs a	16	Q. Look, if you would, at column 8 in
17	search.	17	Iwamura, and I guess this begins on line 13
18		18	or 14, runs down to about line 20.
18	Q. Even though an exact match, in fact, is present in the reference data set?	10 19	A. Okay.
20		20	A. Okay. Yes.
1	MR. LUNER: Objection to form.		
21	A. So the way, my understanding of	21	Q. What do you understand Iwamura to
22	Iwamura, right, so when it goes and	22	be describing here?
23	preprocesses the melodies to skip over the	23	A. So the lines, so there are kind of
24	unimportant portions as part of the search	24	two components there. So the first
25	process, you know, this is really what it	25	component, right, describes instead of
	Page 139		e
1	does, it does to some extent some type of	1	looking at peaks, to look at dips or more
2	does, it does to some extent some type of future extractions. So when it searches,	2	dips in here than peaks, as a way to further
2 3	does, it does to some extent some type of future extractions. So when it searches, given that you just query, it identifies the	2 3	looking at peaks, to look at dips or more dips in here than peaks, as a way to further reduce the number of comparisons they make.
2 3 4	does, it does to some extent some type of future extractions. So when it searches, given that you just query, it identifies the best match, you know, with respect to the	2 3 4	looking at peaks, to look at dips or more dips in here than peaks, as a way to further reduce the number of comparisons they make. Q. I may have directed you to the
2 3	does, it does to some extent some type of future extractions. So when it searches, given that you just query, it identifies the	2 3 4 5	looking at peaks, to look at dips or more dips in here than peaks, as a way to further reduce the number of comparisons they make. Q. I may have directed you to the wrong portion. I was asking about column 8,
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Karypis

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	Page 142		Page 144
1	you were to compare the highest peak in the	1	mean there when it says, "Another peak can be
2	query to the highest peak in the reference	2	used for the search"?
3	and find a match, you could discontinue the	3	A. It's an example of what they have
4	comparisons between that query and that	4	over there, they provide a clear example of
5	reference, return that reference as a match?	5	what is the other peak. And in the first
6	A. I don't know how you disclose	6	case, the peak would be the first one, which
7	something like that.	7	in the example it would be that star 5. And
8	Q. If you were to do that, that would	8	the second peak would be the star 5 in
9	accelerate the search, correct?	9	location 7.
10	A. The question now becomes what we	10	Q. So what this indicates is that
11	define by match. If the match over here is	11	Iwamura doesn't always consider all the peaks
12	an exact match, and then, yes, that connects	12	in the query, correct?
13	it. But if the match is not an exact match,	13	A. What do you mean by "consider"?
14	it doesn't mean that there is no other	14	Q. This indicates that if an exact
15	peak-aligned match that would have that lower		match is found by comparing the first peak in
16 17	score, so that by itself is not a select	16 17	the query to the peaks in the reference, the
17	search.	17	search won't continue on to another peaks in
18	Q. What if it's a match within a certain threshold?	18	the query, correct?
20		20	A. So that rate of passage does not indicate that the search was stopped.
20	A. What do you mean by "a match within a certain threshold"?	20	Q. So where it indicates in line 27,
$\frac{21}{22}$	Q. So in other words, if the highest	$\frac{21}{22}$	"In this case no exact result is obtained, so
22	point in the query is in line with the	22	another search will be done with the second
23	highest point in the reference, and the	23	peak."
24	calculation yields at least absolute	25	Do you see that?
45	calculation yields at least absolute		
	-		-
	Page 143		Page 145
1	Page 143 difference of three or less, it's defined as	1	Page 145 A. Yes.
1 2	Page 143 difference of three or less, it's defined as a match.	1 2	Page 145 A. Yes. Q. Does that not indicate that if an
1 2 3	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form.	1 2 3	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to
1 2 3 4	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is	1 2 3 4	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second
1 2 3 4 5	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the	1 2 3 4 5	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place?
1 2 3 4 5 6	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody	1 2 3 4 5 6	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form.
1 2 3 4 5 6 7	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know,	1 2 3 4 5 6 7	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the
1 2 3 4 5 6 7 8	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user	1 2 3 4 5 6 7 8	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my
1 2 3 4 5 6 7 8 9	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once	1 2 3 4 5 6 7 8 9	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use
1 2 3 4 5 6 7 8 9 10	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and	1 2 3 4 5 6 7 8 9 10	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a
1 2 3 4 5 6 7 8 9 10 11	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match.	1 2 3 4 5 6 7 8 9 10 11	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score.
1 2 3 4 5 6 7 8 9 10 11 12	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you	1 2 3 4 5 6 7 8 9 10 11 12	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you
1 2 3 4 5 6 7 8 9 10 11 12 13	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct?	1 2 3 4 5 6 7 8 9 10 11 12 13	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify,	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work.	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search,	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search, correct?	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that particular record, I would pick up a second
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search, correct? A. That will speed up the search, yes.	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that particular record, I would pick up a second peak and do the same thing.
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search, correct? A. That will speed up the search, yes. Q. Let's turn over to column 9, if you	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that particular record, I would pick up a second peak and do the same thing. Q. And if an exact match is found in
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search, correct? A. That will speed up the search, yes. Q. Let's turn over to column 9, if you would, and take a moment to look over the	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that particular record, I would pick up a second peak and do the same thing. Q. And if an exact match is found in what you just described, you would not move
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search, correct? A. That will speed up the search, yes. Q. Let's turn over to column 9, if you would, and take a moment to look over the text from lines 24 through about 32.	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that particular record, I would pick up a second peak and do the same thing. Q. And if an exact match is found in
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\\23\end{array} $	Page 143 difference of three or less, it's defined as a match. MR. LUNER: Object to the form. A. So what is defined as a match is that of identifying whether or not the reference, you know, contains some melody that is peaked aligned, who is, you know, distance is less than or equal to a user supply constant, right, then, you know, once you find one of those, then we can turn and search and identify that thing as a match. Q. And by employing that approach you could accelerate the search, correct? A. So by employing that approach, you can, you know, you will not need to identify, you know, search any other peaks that you've seen in the regular reference work. Q. And thereby accelerate the search, correct? A. That will speed up the search, yes. Q. Let's turn over to column 9, if you would, and take a moment to look over the	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\\23\end{array} $	Page 145 A. Yes. Q. Does that not indicate that if an exact match were found using comparison to the first peak in the query, that that second search wouldn't take place? MR. LUNER: Objection to form. A. So my identification of the paragraph is the fall line, so my understanding of that algorithm is when I use the first peak, right, I align it with a query against a reference, a computer score. If I go through the process by aligning, you know, shifting the first peak to all the peaks in the reference, if I have a that would give me a set of scores and a set of matches. So there is no exact match of me doing that. And then in the process of again trying to match a melody against that particular record, I would pick up a second peak and do the same thing. Q. And if an exact match is found in what you just described, you would not move on that second search, correct?

37 (Pages 142 - 145)

		J P15	
	Page 146		Page 148
1	Q. Now, in the case using the peak	1	five-digit sequence in the reference,
2	search approach in Iwamura, where you have a		correct?
3	short query and a longer reference melody,	3	A. I believe the match within the
4	it's possible that the query would match the	4	context of the Iwamura is a melody, so the
5	reference in multiple locations, correct?	5	match is really the reference.
6	A. That is possible, yes.	6	Q. And you evaluate whether you have a
7	(Karypis Exhibit 10, Single-page	7	matching melody by virtue of whether the
8	chart, marked for identification, this	8	query matches the melody segments within the
9	date.)	9	reference, correct?
10	Q. I want to take a look at an example	10	A. So you evaluate the quality of the
11	sequence here that we will mark as	11	match by evaluating how well the query
12	Exhibit 10. Exhibit 10, do you see the top	12	matches, you know, the best matching segmen
13	where it says "Query: 5, 4, 3, 2, 1"?	13	in the reference.
14	A. Yes.	14	Q. Let's look back at Iwamura in
15	Q. And can you accept hypothetically	15	column 8, please, in particular lines 4
16	that that's a query string for use in a peak	16	through 12 of column 8. And there Iwamura
17	search, according to Iwamura?	17	teaches that in addition to doing a peak
18	A. I do.	18	search, you could also do a dip search,
19	Q. And below that it has a string of	19	right?
20	numbers and a reference, do you see that?	20	A. Uh-huh.
21	A. I do.	21	Q. Now is it possible any given query
22	Q. Can you accept hypothetically that	22	or reference work that the best matching
23	that is a reference melody string for a	23	melody segment within that reference work
24	comparison, according to the peak search	24	would be at a dip?
25	process of Internation	25	
25	process of Iwamura?	25	A. What exactly do you mean by being
25	Page 147	25	A. What exactly do you mean by being Page 149
1	•	1	
1 2	Page 147 A. I do. Q. Now, if we were to compare the	1 2	Page 149
1	Page 147 A. I do.	1	Page 149 at a dip? Q. Let me make sure that we're finding this the same way.
1 2 3 4	Page 147 A. I do. Q. Now, if we were to compare the	1 2	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip
1 2 3	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted	1 2 3	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip
1 2 3 4	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the	1 2 3 4	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip
1 2 3 4 5 6 7	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is.	1 2 3 4 5	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura?
1 2 3 4 5 6	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query?	1 2 3 4 5 6	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition
1 2 3 4 5 6 7	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is.	1 2 3 4 5 6 7	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a
1 2 3 4 5 6 7 8 9 10	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4,	1 2 3 4 5 6 7 8	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum.
1 2 3 4 5 6 7 8 9 10 11	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match?	1 2 3 4 5 6 7 8 9 10 11	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you
1 2 3 4 5 6 7 8 9 10 11 12	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is.	1 2 3 4 5 6 7 8 9 10	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip
1 2 3 4 5 6 7 8 9 10 11 12 13	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3,	1 2 3 4 5 6 7 8 9 10 11 12 13	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right?
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query?	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is.	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted sequence 5, 4, 3, 2, 1 again be a match to the query? A. It is.	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the query to the reference aligned at the dip?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted sequence 5, 4, 3, 2, 1 again be a match to the query? A. It is. Q. So in this example, is it fair to	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the query to the reference aligned at the dip? A. Correct. Q. And is it possible that taking that query aligned at the dip would yield the
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	 Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted sequence 5, 4, 3, 2, 1 again be a match to the query? A. It is. Q. So in this example, is it fair to say that there are four exact matches to the 	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the query to the reference aligned at the dip? A. Correct. Q. And is it possible that taking that
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted sequence 5, 4, 3, 2, 1 again be a match to the query? A. It is. Q. So in this example, is it fair to say that there are four exact matches to the query within the reference?	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the query to the reference aligned at the dip? A. Correct. Q. And is it possible that taking that query aligned at the dip would yield the
1 2 3 4 5 6 7 8	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted sequence 5, 4, 3, 2, 1 again be a match to the query? A. It is. Q. So in this example, is it fair to say that there are four exact matches to the query within the reference? A. So within the reference there are	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the query to the reference aligned at the dip? A. Correct. Q. And is it possible that taking that query aligned at the dip would yield the lowest absolute difference of any melody
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\end{array} $	Page 147 A. I do. Q. Now, if we were to compare the query 5, 4, 3, 2, 1 to the reference depicted on Exhibit 10, is the first instance of the sequence 5, 4, 3, 2, 1 in the reference a match for the query? A. It is. Q. And is the second instance of 5, 4, 3, 2, 1 highlighted in orange also a match? A. Yes, it is. Q. And is the yellow sequence 5, 4, 3, 2, 1 also a match for the query? A. Yes, it is. Q. And would the blue highlighted sequence 5, 4, 3, 2, 1 again be a match to the query? A. It is. Q. So in this example, is it fair to say that there are four exact matches to the query within the reference? A. So within the reference there are four portions that match exactly to the	$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\\20\\21\\22\end{array} $	Page 149 at a dip? Q. Let me make sure that we're finding this the same way. How do you understand the dip segments to be defined according to Iwamura? A. My understanding of the definition of a dip is going to be a local minimum and a peak being a local maximum. Q. So in the dip search process you would align a dip from the query with a dip in the reference, right? A. That's my understanding of when it says you can use dips and instead of peaks, yes. Q. And you would compare the notes as aligned in the reference pardon me, in the query to the reference aligned at the dip? A. Correct. Q. And is it possible that taking that query aligned at the dip would yield the lowest absolute difference of any melody segment in the work?

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	1		
	Page 150		Page 152
1	and compare it to the reference work using	1	peak search approach and a dip search
2	the peak search, you would not find that	2	approach, what you return at the end is the
3	closest matching segment in the reference,	3	best of the two. The best result can be one
4	would you?	4	that is coming from the dip search portion of
5	A. Can you repeat that question?	5	the overall search.
6	MR. NEMEC: Sure. I'll just read	6	Q. All right.
7	it back off the record here.	7	Now in that scenario we take that
8	Q. Continuing with that hypothetical	8	same query and that same reference, and we
9	scenario, if you were then to take the query	9	have found the best match at a dip. But we
10	and compare it to the reference work using	10	now compare that query to that reference
11	the peak search, you would not find that	11	using only the peak search, we're not going
12	closest matching segment in the reference?	12	to find that best matching segment, are we?
13	MR. LUNER: Objection to form.	13	A. Again, that goes back to the whole
14	A. So my notion of what is the closest	14	notion of the definition of a search and what
15	match and what is not is a function of the	15	is the result. But if I have an algorithm
16 17	algorithm that you use to find it. So if I	16 17	that is designed to find the best peak, let's
	do a peak search approach, what I would		call it aligned in the segment, right, the
18	return back as the closest would be the	18	peak search approach will be the best. But
19	closest as a result of the peak search	19	if an algorithm is designed to find the best
20 21	approach.	20	dip aligned segment, you know, that would be
21	So with respect to that particular	21 22	the best.
22	search strategy or algorithm, that's the	22	I mean for their respective
23	best, you know, matching segment.	23 24	algorithm, in terms of what they're designed
24	Q. Now, Iwamura teaches that you could	24 25	to do, you know, what the the result that
25	also do the comparison using both peaks and	23	comes out from the dip search approach may
	Page 151		Page 153
1	dips, right?	1	not necessarily be an allowable result of the
2	A. There is a discussion about that.	2	peak search approach. Because this is not
3	Q. And in that scenario, the closest	3	what the algorithm is designed to do. But
4	matching segment would be the comparison	4	the peak search approach will identify the
_			
5	between either a peak or a dip in the	5	best match.
6	between either a peak or a dip in the reference that yields the least absolute	5 6	best match. Q. So if the algorithm isn't
6 7	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding	5 6 7	best match. Q. So if the algorithm isn't considered, isn't configured to consider a
6 7 8	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct?	5 6 7 8	best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the
6 7 8 9	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct?A. So if I do a search in which I use	5 6 7 8 9	best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right?
6 7 8 9 10	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct?A. So if I do a search in which I use both a peak search approach and also a dip	5 6 7 8 9 10	best match.Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right?A. If an algorithm is designed to find
6 7 8 9 10 11	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct?A. So if I do a search in which I use both a peak search approach and also a dip search approach, and I return back the best	5 6 7 8 9 10 11	 best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right? A. If an algorithm is designed to find a certain type of matches, right, it will not
6 7 8 9 10 11 12	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct?A. So if I do a search in which I use both a peak search approach and also a dip search approach, and I return back the best match of both of them, right. So that would	5 6 7 8 9 10 11 12	 best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right? A. If an algorithm is designed to find a certain type of matches, right, it will not find a match that it is not designed to find.
6 7 8 9 10 11 12 13	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct?A. So if I do a search in which I use both a peak search approach and also a dip search approach, and I return back the best match of both of them, right. So that would be the best match of the combined approach.	5 6 7 8 9 10 11 12 13	 best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right? A. If an algorithm is designed to find a certain type of matches, right, it will not find a match that it is not designed to find. So in your example, right, the type
6 7 8 9 10 11 12 13 14	 between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct? A. So if I do a search in which I use both a peak search approach and also a dip search approach, and I return back the best match of both of them, right. So that would be the best match of the combined approach. Q. And that best match might occur at 	5 6 7 8 9 10 11 12 13 14	 best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right? A. If an algorithm is designed to find a certain type of matches, right, it will not find a match that it is not designed to find. So in your example, right, the type of match that you consider to be your best is
6 7 8 9 10 11 12 13 14 15	 between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct? A. So if I do a search in which I use both a peak search approach and also a dip search approach, and I return back the best match of both of them, right. So that would be the best match of the combined approach. Q. And that best match might occur at a dip as opposed to a peak, right? 	5 6 7 8 9 10 11 12 13 14 15	 best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right? A. If an algorithm is designed to find a certain type of matches, right, it will not find a match that it is not designed to find. So in your example, right, the type of match that you consider to be your best is a match in which an algorithm is designed to
6 7 8 9 10 11 12 13 14 15 16	between either a peak or a dip in the reference that yields the least absolute difference when aligned with a corresponding peak or dip in the reference, correct? A. So if I do a search in which I use both a peak search approach and also a dip search approach, and I return back the best match of both of them, right. So that would be the best match of the combined approach. Q. And that best match might occur at a dip as opposed to a peak, right? MR. LUNER: Objection to form.	5 6 7 8 9 10 11 12 13 14 15 16	 best match. Q. So if the algorithm isn't considered, isn't configured to consider a particular match, then that can't be the closest match; is that right? A. If an algorithm is designed to find a certain type of matches, right, it will not find a match that it is not designed to find. So in your example, right, the type of match that you consider to be your best is a match in which an algorithm is designed to find. But the peak search approach will find
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		J PIS	
1	Page 154	1	Page 156
1	among those will return the best.		A. That's my understanding of that.
2	Q. So I'll put it a little bit	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	Q. And if every peak segment in that
3	differently then. If, say, a portion of the	3	reference that's compared has an error above
4	reference that you don't consider in the	4	the limit we've defined, then that particular
5	search, then that portion of the reference,	5	song will not be considered a match, right?
6	by definition, cannot be the closest match?	6	A. Would you repeat your question
7	A. What do you mean when you say you	7	again?
8	cannot consider a portion of the reference?	8	Q. If all the peak segments within a
9	Is it something that you choose not to	9	reference, have an error above the limit that
10	consider, or your algorithm, you know,	10	we've defined, then Iwamura won't consider
11	specifically does not consider those things	11	that reference to be a match, correct?
12	in identifying the allowable matches?	12	A. I don't think Iwamura discloses
13	Q. Well, using the example of the peak	13	that.
14	versus the dip search in Iwamura, if you are	14	Q. Which part of what I said?
15	running the peak search, you are not	15	A. That if everything that you just
16	considering the dips, correct?	16	said.
17	A. You may not be considering, not	17	Q. How is it that you understand the
18	necessarily. You would still be considering	18	limit function to operate?
19	some of the dips, if they include it in their	19	A. So my understanding of the limit
20	peak.	20	function is we've done when I called the
21	Q. So that is what I'm trying to	21	alignment of the query against that portion
22	convey by the portion of the reference that's	22	of the reference, as I go down each aligned
23	not considered, one example of it. Do you	23	position and compute the actual difference,
24	follow?	24	if that thing, you know, goes above a certain
25	A. No.	25	threshold, then I can, you know, stop going
	Page 155		Page 157
1	Q. Okay. Sounded like you did.	1	down the path, down note by note to compute
2			
	Why don't we go back to the two	2	the difference, the actual difference, and
3	options that you proposed. In one instance	3	the difference, the actual difference, and just shift to the next peak.
3 4	options that you proposed. In one instance you said the algorithm that's excluding a	3 4	the difference, the actual difference, and just shift to the next peak.Q. And then when you shift to that
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		J F	
1	Page 158		Page 160
1	Q. I apologize, I didn't hear you.	1	A. I do not know.
2	You said you do or don't recall seeing	2	MR. NEMEC: We will take our coffee
3	A. I do not recall seeing whether or	3	break.
4	not they provide any guidelines as to what	4	THE VIDEOGRAPHER: Okay. The time
5	that thing would be.	5	is 2:40 stand by.
6	Q. Do you think it's possible that the	6	The time is 2:48. We're going off
7	limit function could be set at zero?	7	the record. This is the end of disk
8	A. Well, if the limit function is set	8	number 3. Thanks.
9	to zero, then the algorithm that they	9	(A brief recess was taken.)
10	describe would only identify exact matches if	10	THE VIDEOGRAPHER: We are now back
11	such matches occur, if my understanding is	11	on the record. The time is 3:01. This
12	correct.	12	is the beginning of disk number 4.
13	Q. Would you agree that the search	13	MR. NEMEC: Let's mark as
14	time in the peak note search process of	14	Exhibit 11 U.S. Patent 5,874,686, the
15	Iwamura is proportional to the number of	15	Ghias, please.
16	peaks in the reference work?	16	(Karypis Exhibit 11, Photocopy of
17	A. So the search, the amount of time	17	U.S. Patent No. 5,874,686, marked for
18	it takes to search a particular record in the	18	identification, this date.)
19	peak search approach, right, will depend,	19	Q. Do you have Exhibit 11, Dr.
20	among others, on the number of peaks.	20	Karypis?
21	Q. And you believe it would be roughly	21	A. Yes, I do.
22	a proportional relationship between the	22	Q. And this is the Ghias prior art
23	search time and the number of peaks?	23	reference that you discuss in your
24	A. The more the peaks, the more time,	24	declaration, correct?
25	yes.	25	A. Correct.
	Page 159		Page 161
1	Q. And the less peaks, the less time,	1	Q. Is it fair to say that Ghias
2	correspondingly?	2	discloses a system where you can hum a tune
3	A. Correct.	3	and the system will try to identify the song
4	MR. LUNER: I think we're running	4	that you are humming?
5	low on caffeine.	5	A. Yes, it's identifying melody from a
6	MR. NEMEC: I have a couple more	6	database.
7	questions on this reference and I will	7	Q. And it does that by comparing the
8	be done, so I'll wrap up the line and we	8	relative pitch values from the hummed query
9	will take a coffee break. Excellent.	9	melody to the relative pitch values of known
10	Q. One of the file formats that	10	reference melodies; is that right?
11	Iwamura discusses is the mini file format,	11	A. I believe so.
12	correct?	12	Q. Ghias discloses comparing a text
13	A. Correct.	13	representation of the notes in the query to a
14	A. CONCL.		
		14	text representation of the notes in the
1	Q. Just briefly, how would you	14 15	text representation of the notes in the reference, right?
15	Q. Just briefly, how would you characterize what the mini file format is?	15	reference, right?
15 16	Q. Just briefly, how would youcharacterize what the mini file format is?A. I'm not an expert on the mini file	15 16	reference, right? A. That is correct.
15 16 17	Q. Just briefly, how would youcharacterize what the mini file format is?A. I'm not an expert on the mini fileformat, but my understanding is this is a	15 16 17	reference, right? A. That is correct. Q. In particular, Ghias represents
15 16 17 18	Q. Just briefly, how would you characterize what the mini file format is?A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know,	15 16 17 18	reference, right?A. That is correct.Q. In particular, Ghias representsqueries and references as strings of the
15 16 17 18 19	Q. Just briefly, how would you characterize what the mini file format is?A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know, MP3 files.	15 16 17 18 19	reference, right?A. That is correct.Q. In particular, Ghias represents queries and references as strings of the characters U, S and D, right?
15 16 17 18 19 20	 Q. Just briefly, how would you characterize what the mini file format is? A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know, MP3 files. Q. There is also a description or a 	15 16 17 18 19 20	 reference, right? A. That is correct. Q. In particular, Ghias represents queries and references as strings of the characters U, S and D, right? A. Yes.
15 16 17 18 19 20 21	 Q. Just briefly, how would you characterize what the mini file format is? A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know, MP3 files. Q. There is also a description or a disclosure of a way file format in Iwamura, 	15 16 17 18 19 20 21	 reference, right? A. That is correct. Q. In particular, Ghias represents queries and references as strings of the characters U, S and D, right? A. Yes. Q. U, S and D referring to whether the
15 16 17 18 19 20 21 22	 Q. Just briefly, how would you characterize what the mini file format is? A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know, MP3 files. Q. There is also a description or a disclosure of a wav file format in Iwamura, correct? 	15 16 17 18 19 20 21 22	 reference, right? A. That is correct. Q. In particular, Ghias represents queries and references as strings of the characters U, S and D, right? A. Yes. Q. U, S and D referring to whether the note is the same, an up note or a down note,
15 16 17 18 19 20 21 22 23	 Q. Just briefly, how would you characterize what the mini file format is? A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know, MP3 files. Q. There is also a description or a disclosure of a wav file format in Iwamura, correct? A. Uh-huh. 	15 16 17 18 19 20 21 22 23	 reference, right? A. That is correct. Q. In particular, Ghias represents queries and references as strings of the characters U, S and D, right? A. Yes. Q. U, S and D referring to whether the note is the same, an up note or a down note, as compared to the preceding note?
15 16 17 18 19 20 21 22	 Q. Just briefly, how would you characterize what the mini file format is? A. I'm not an expert on the mini file format, but my understanding is this is a media file format. It predates, you know, MP3 files. Q. There is also a description or a disclosure of a wav file format in Iwamura, correct? 	15 16 17 18 19 20 21 22	 reference, right? A. That is correct. Q. In particular, Ghias represents queries and references as strings of the characters U, S and D, right? A. Yes. Q. U, S and D referring to whether the note is the same, an up note or a down note,

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Karypis

	Page 162		Page 164
1	how Ghias goes about determining whether a	1	because I'm getting myself tied in knots
2	query matches a reference?	2	here.
3	A. So my understanding of how Ghias	3	If two if a query has the same
4	goes about doing that is it performs a	4	number of mismatched references when compared
5	substring search of the string representing	5	to two different
6	the query, again, the string representing a	6	MR. NEMEC: Strike that.
7	record in the database; and then based on	7	Q. If a query has the same number of
8	that it computes a score, and then it	8	mismatched characters when compared to
9	returns, you know, some of those melodies as	9	reference 1 as it does when compared to
10	a result of that query.	10	reference 2, will Ghias consider reference 1
11	Q. How does Ghias go about determining	11	and reference 2 to be equal quality matches?
12	which reference most closely matches a query?	12	A. So if the best, if a substring with
13	A. So I believe the way that they use	13	the least number of mismatches of the query
14	it is they find a substring that has the	14	in reference 1, which is if the number of
15	least number of character differences when	15	mismatches of the best matching substrate of
16	they, it is aligned in a gapless way.	16	query to reference 1 is the same as the
17	Q. So I'm sorry, go ahead.	17	number of mismatches of the best matching
18	A. Actually, they can potentially	18	substring of query to reference 2, right,
19	allow insertions and deletions as well, but	19	then, you know, I believe Ghias will consider
20	it's really a substring alignment.	20	those two things as equal quality melodies or
21	Q. Okay. So by way of example, if a	21	references, good overall matches.
22	if a query string was SSS and a reference	22	Q. So is Ghias able, in the instance
23	string was SSU, how would how would Ghias	23	of comparing SSS
24	characterize the difference between those	24	MR. NEMEC: Strike that.
25	two?	25	Q. Can Ghias determine whether SSS is
	Page 163		Page 165
1	A. So Ghias would characterize that	1	a closer match to SSU than SSD is?
2	those two strings have a one-character	2	A. So the query is SSS, and the
3	mismatch.	3	reference is SSU and SSD, so both references
4	Q. And how would Ghias go about	4	are one-character mismatch with a query. And
5	determining the difference between a string	5	if they, if the metric is in the number of
6	SSS and SSD?	6	mismatches, those two things will be, those
7	MR. NEMEC: Strike that.	7	two things would be, you know, the same,
8	Q. What would Ghias characterize as the difference between SSS and SSD?	8	equally good matches. Q. If SSU is the query and the two
9	the difference between SSS and SSD?	9	
		10	
10	A. I believe will characterize as 1.	10	references are SSS and SSD, will Ghias rank
11	A. I believe will characterize as 1.Q. If two references have the same	11	references are SSS and SSD, will Ghias rank those as equally good matches?
11 12	A. I believe will characterize as 1.Q. If two references have the same number of mismatched characters as compared	11 12	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character
11 12 13	A. I believe will characterize as 1.Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider	11 12 13	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two
11 12 13 14	A. I believe will characterize as 1.Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches?	11 12 13 14	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references.
11 12 13 14 15	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. 	11 12 13 14 15	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias
11 12 13 14 15 16	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, 	11 12 13 14 15 16	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of
11 12 13 14 15 16 17	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. 	11 12 13 14 15 16 17	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct?
11 12 13 14 15 16 17 18	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number 	11 12 13 14 15 16 17 18	 references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct.
11 12 13 14 15 16 17 18 19	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number of mismatched characters as compared to a 	11 12 13 14 15 16 17 18 19	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct. Q. If the search in Ghias' run has
11 12 13 14 15 16 17 18 19 20	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number of mismatched characters as compared to a given reference, will Ghias consider them to 	11 12 13 14 15 16 17 18 19 20	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct. Q. If the search in Ghias' run has determined that there are ten references that
11 12 13 14 15 16 17 18 19 20 21	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? 	11 12 13 14 15 16 17 18 19 20 21	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct. Q. If the search in Ghias' run has determined that there are ten references that differ by only one character, how would Ghias
11 12 13 14 15 16 17 18 19 20 21 22	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? A. As far as I know, you don't match a 	11 12 13 14 15 16 17 18 19 20 21 22	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct. Q. If the search in Ghias' run has determined that there are ten references that differ by only one character, how would Ghias go about ranking those ten?
11 12 13 14 15 16 17 18 19 20 21 22 23	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? A. As far as I know, you don't match a query to a reference. It's the other way 	11 12 13 14 15 16 17 18 19 20 21 22 23	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct. Q. If the search in Ghias' run has determined that there are ten references that differ by only one character, how would Ghias go about ranking those ten? A. So if they rank least that so if
11 12 13 14 15 16 17 18 19 20 21 22	 A. I believe will characterize as 1. Q. If two references have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? MR. LUNER: Objection to form. MR. NEMEC: Let me ask that again, I apologize. Q. If two queries have the same number of mismatched characters as compared to a given reference, will Ghias consider them to be equal quality matches? A. As far as I know, you don't match a 	11 12 13 14 15 16 17 18 19 20 21 22	references are SSS and SSD, will Ghias rank those as equally good matches? A. I believe so, the one-character difference between the query and the two references. Q. One of the things that Ghias teaches is that it can output a rank list of matches, correct? A. That is correct. Q. If the search in Ghias' run has determined that there are ten references that differ by only one character, how would Ghias go about ranking those ten?

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Karypis

1	Page 166	1	Page 168
1	then the, you know, ranking between those	$\begin{vmatrix} 1 \\ 2 \end{vmatrix}$	equivalent; but you can have what is called a
2	things in terms of which one is the best is	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	weighted mismatch in which certain mismatches
3	both irrelevant and arbitrary. You know, all	3	weighed less or more, but in which case can
4	of them are equally good answers to that	4	create an order is one of those strings.
5	query, given those constraints.	5	But if I use a symmetric of
6	Q. Now, it may be of that list of ten	6	similarity or distance between two strings,
7	that one of the referenced melodies itself	7	the number of mismatched characters, those
8	matches the hummed melody closer than another	8	two would be equally good.
9	of the ten, correct?	9	Q. My question was separate from
10	MR. LUNER: Objection to form.	10	Ghias.
11	A. So can you repeat your question?	11	A. Okay.
12	Q. So notwithstanding the fact that	12	Q. So if we have a piece of music
13	the search in Ghias yields ten references	13	that's represented by SSU, and we have
14	that differ by only one character, and that	14	another piece of music that is represented by
15	those ten references, as far as the Ghias	15	SSS and another represented by SSD, which is
16	search process is concerned, would be equally	16	more similar to SSU, SSS or SSD?
17	similar or equally different, the underlying	17	MR. LUNER: Objection to form.
18	songs	18	A. How do you define similarity?
19	MR. NEMEC: Strike that.	19	Q. How different the notes are.
20	Q. The fact that a reference, the fact	20	A. Do you consider the if I look in
21	that a query in Ghias differs by the same	21	the underlying note, that would be a
22	number of characters as compared to two	22	different similarity than what I can compute
23	different references doesn't necessarily mean	23	by just having that another presentation,
24	that the query song is an equal match to both	24	unless you define a distance between the
25	of the reference melodies, correct?	25	characters of their presentation.
	Page 167		Page 169
1	MR. LUNER: Objection to form.	1	Q. Column 2 of Ghias discloses an
2	A. So again, within the method that	2	error tolerance, if you look at lines 2
3	Ghias discloses, right, a query is a string.	3	through 50 to 53?
4	So based on that query, it identifies,	4	Do you see that?
5	computes a matching scroll to the references.	5	A. 50 to 53?
6	And if there are a number of references that	6	Q. I apologize, 52 to 53.
7	have the same scroll, number of mismatched	7	A. 52 to 53. Let me take a minute.
8	characters, right, for the purpose of the	8	Yes, I see that line.
9	search, right now, for the purpose of the	9	Q. What do you understand this error
10	algorithm disclosed in Ghias, those things	10	tolerance to mean?
11	are equally good matches.	11	A. My understanding of an error
		12	tolerance is the maximum number of allowed
12	Q. So putting Ghias aside, if a query		
	Q. So putting Ghias aside, if a query piece of music is represented by SSU, which	13	mismatches between the query and the best
13	piece of music is represented by SSU, which	13	mismatches between the query and the best matching segment or melody.
13 14	piece of music is represented by SSU, which referenced piece of music would be more	13 14	matching segment or melody.
13 14 15	piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD?	13 14 15	matching segment or melody.Q. So it's not possible that the error
13 14 15 16	piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form.	13 14 15 16	matching segment or melody.Q. So it's not possible that the error tolerance would mean that the output is
13 14 15 16 17	piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two	13 14 15 16 17	matching segment or melody.Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum
13 14 15 16 17 18	piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU.	13 14 15 16 17 18	matching segment or melody.Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches?
13 14 15 16 17 18 19	piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU. Q. The query is SSU	13 14 15 16 17 18 19	matching segment or melody.Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches?A. What do you mean by that?
13 14 15 16 17 18 19 20	 piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU. Q. The query is SSU A. The query is SSU. 	13 14 15 16 17 18 19 20	 matching segment or melody. Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches? A. What do you mean by that? Q. In other words, is it not possible
13 14 15 16 17 18 19 20 21	 piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU. Q. The query is SSU A. The query is SSU. Q and the references are SSS and 	13 14 15 16 17 18 19 20 21	 matching segment or melody. Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches? A. What do you mean by that? Q. In other words, is it not possible that the error tolerance could mean that the
13 14 15 16 17 18 19 20 21 22	 piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU. Q. The query is SSU A. The query is SSU. Q and the references are SSS and SSD. 	13 14 15 16 17 18 19 20 21 22	 matching segment or melody. Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches? A. What do you mean by that? Q. In other words, is it not possible that the error tolerance could mean that the system only returns the ten best matches?
12 13 14 15 16 17 18 19 20 21 22 23 24	 piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU. Q. The query is SSU A. The query is SSU. Q and the references are SSS and SSD. A. The method that Ghias discloses in 	13 14 15 16 17 18 19 20 21 22 23	 matching segment or melody. Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches? A. What do you mean by that? Q. In other words, is it not possible that the error tolerance could mean that the system only returns the ten best matches? A. My understanding of the error
 13 14 15 16 17 18 19 20 21 22 	 piece of music is represented by SSU, which referenced piece of music would be more similar to it, SSS or SSD? MR. LUNER: Objection to form. A. So if my query is SSS, and the two references is SSD and SSU. Q. The query is SSU A. The query is SSU. Q and the references are SSS and SSD. 	13 14 15 16 17 18 19 20 21 22	 matching segment or melody. Q. So it's not possible that the error tolerance would mean that the output is limited to a set number of matches or maximum number of matches? A. What do you mean by that? Q. In other words, is it not possible that the error tolerance could mean that the system only returns the ten best matches?

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		ypis	
1	Page 170		Page 172
1	maximum number of allowed mismatches. I	1	explains that a user can perform a new query
2	don't recall seeing it another way.	2	on a restricted search list consisting of
3	Q. So we discussed a moment ago, and	3	songs just retrieved, correct?
4	let me just reconfirm, that one of the	4	A. Right.
5	possible outputs from Ghias is a ranked list	5	Q. Could the new query that's
6	of matching melodies; is that right?	6	described there be a different portion of the
7	A. Yes, I believe so.	7	same song that was searched in the original
8	Q. Is it an unlimited list, or is	8	query?
9	there some cap that Ghias puts on the number	9	MR. LUNER: Objection to form.
10	of entries included on that ranked list?	10	A. That can be a possibility.
11	A. So my recollection in reading	11	Q. Could the new query be a completely
12	Ghias, the size of the ranked list depends on	12	different song?
13	the error tolerance. So if the error	13	A. The segments can perform a new
14	tolerance is said to be high, the ranked list	14	query and puts no restrictions on the type of
15	would be larger, potentially; if it's low,	15	a query.
16	it's going to be smaller.	16	Q. Now, if we were to return, pardon
17	I don't recall seeing a	17	me. If we were to run a first search
18	specification of the fixed number of results.	18	MR. NEMEC: Strike that.
19	Q. So if, for example, the error	19	Q. If we were to run a search
20	tolerance were set at one, the ranked list	20	according to Ghias, using the chorus from a
21	would return all those references that had a	21	song, would that necessarily return the same
22	difference of one as compared to the query?	22	results as if we were to use the guitar solo
23	A. What a search will return is all	23	from the same song as the query run against
24	the references with best matching substring	24	the reference database?
25	that has at most one difference. That means	25	MR. LUNER: Objection to form.
	that has at most one difference. That means Page 171	25	MR. LUNER: Objection to form. Page 173
		25 1	Page 173 A. It may or may not.
25	Page 171		Page 173
25 1	Page 171 it will return those that have zero and those that have one, assuming that they are non Q. Okay. Understood.	1	Page 173 A. It may or may not. Q. So the results could be different? A. It could be different, yes.
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Karypis

1	Page 174		Page 176
1	Is the user going to get a list of	1	Ghias, do you think it's a desirable feature
2	songs by title? Is that your understanding	2	that search keys could be matched with any
3	of what Ghias is teaching?	3	portion of the melody rather than just the
4	A. I don't recall what is the form of	4	beginning?
5	the output, but, you know, a list of titles	5	MR. LUNER: Objection to form.
6	is a potential output.	6	A. I can consider cases in which my
7	Q. We know it's coming in list form,	7	goal is to find a melody based on something
8	right?	8	that was hummed on the radio, into a
9	A. Well, it's a ranked list.	9	microphone, and they start humming the melody
10	Q. If you will look at column 7, lines	10	from an arbitrary point within the melody; so
11	36 through 40 of Ghias, please.	11	doing a substring match, you know, will
12	A. You said column 7, lines	12	increase the chances of identifying the
13	Q. 36 to 40.	13	melody or not.
14	A. Yes.	14	Q. Does the fact that the search
15	Q. So he says there, "As a consequence	15	described here in column 7 of Ghias is an
16	of using a fast approximate string matching	16	approximate search mean that it doesn't
17	algorithm, search keys can be matched with	17	consider all the data within each reference?
18	any portion of the melody rather than just	18	MR. LUNER: Objection to form.
19	the beginning. As the size of the database	19	A. So I believe the definition of
20	grows larger, however, this may not prove to	20	"approximate" that Ghias the term
21	be an advantage."	21	"approximate string matching" over here
22	What is your understanding of why	22	refers to what would be considered a match,
23	that would not prove to be an advantage?	23	and a match is considered a valid match if it
24	A. I will presume that by enabling a	24	has at most K mismatches. So the term
25	flexibility to locate a substring within a	25	"approximate," right, it used to characterize
	Page 175		Page 177
1	bigger string, you know, that would be	1	what is allowed as part of the answer.
2	somewhat slower than looking at just the	2	Q. So in fact at the top of column 6,
3	beginning.	3	lines 9 through 11, Ghias defines when he
4	Q. How do you believe a person skilled	4	means by "approximate" right?
_		_	means by "approximate," right?
5	in the art would circumvent this	5	A. I believe so.
6	in the art would circumvent this disadvantage?	6	A. I believe so.Q. And he says, "Approximate" "By
6 7	in the art would circumvent this disadvantage? MR. LUNER: Objection to form.	6 7	A. I believe so.Q. And he says, "Approximate" "By approximate is meant the algorithm should be
6 7 8	in the art would circumvent this disadvantage? MR. LUNER: Objection to form. A. So if the type of the query that I	6 7 8	 A. I believe so. Q. And he says, "Approximate" "By approximate is meant the algorithm should be able to take into account various forms of
6 7 8 9	in the art would circumvent this disadvantage? MR. LUNER: Objection to form. A. So if the type of the query that I would like to do is identifying all	6 7 8 9	 A. I believe so. Q. And he says, "Approximate" "By approximate is meant the algorithm should be able to take into account various forms of errors."
6 7 8 9 10	in the art would circumvent this disadvantage? MR. LUNER: Objection to form. A. So if the type of the query that I would like to do is identifying all substrings within a string that can have	6 7 8 9 10	 A. I believe so. Q. And he says, "Approximate" "By approximate is meant the algorithm should be able to take into account various forms of errors." Do you see that?
6 7 8 9 10 11	 in the art would circumvent this disadvantage? MR. LUNER: Objection to form. A. So if the type of the query that I would like to do is identifying all substrings within a string that can have optic k-mismatches. There are a set of 	6 7 8 9 10 11	 A. I believe so. Q. And he says, "Approximate" "By approximate is meant the algorithm should be able to take into account various forms of errors." Do you see that? A. That's what it says, yes.
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45 (Pages 174 - 177)

Karypis

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	Page 178		Page 180
1	Do you think it's an unusual or	1	exactly the same hash as the query, will
2	unacceptable definition?	2	Conwell locate any match?
3	MR. LUNER: Objection to form.	3	A. So if the database has no record
4	A. I think this is one way of defining	4	that it has the exactly the same hash, I
5	approximate stream matching.	5	believe Conwell will not locate a match.
6	MR. NEMEC: Let's mark as	6	Q. And if the database in Conwell
7	Exhibit 12 US patent 6,970,886.	7	contains a reference that is very close match
8	(Karypis Exhibit 12, Photocopy of	8	to the query but matched to a slightly
9	U.S. Patent No. 6,970,886, marked for	9	different hash, will Conwell determine that
10	identification, this date.)	10	that's a match?
11	Q. Is Exhibit 12 the Conwell prior art	11	A. When you say "a close match to the
12	reference that is discussed in your	12	query," are you talking about in terms of the
13	declaration?	13	hash, or in terms of the actual melody?
14	A. Yes, it is.	14	Q. So both. I'll ask the question
15	Q. Is it fair to say that Conwell	15	again, just so it's clear.
16	describes a system which identifies a query	16	If the database in Conwell contains
17	work by hashing the query work and comparing	17	a reference, it's a very close to match to
18	it to hashes and known reference works?	18	the query but maps to a slightly different
19	A. That's a fair characterization.	19	hash, will Conwell determine that that's a
20	Q. And Conwell can look at a reference	20	match?
21	work that is a near match to a query work, if	21	A. So if the hash of the query is
22	the two map the same hash value, correct?	22	different than any of the hashes in the
23	MR. LUNER: Can you repeat the	23	database, the Conwell will not determine a
24	question?	24	match.
25	MR. NEMEC: Sure.	25	Q. Any difference whatsoever in the
	Page 179		
	Page 1/9		
1	-	1	Page 181 hashes will result in a no match
1	Excuse me.	$\frac{1}{2}$	hashes will result in a no match
2	Excuse me. Q. Conwell can look at a reference	2	hashes will result in a no match determination in Conwell; is that right?
2 3	Excuse me. Q. Conwell can look at a reference work that is a near match to a query work, if	2 3	hashes will result in a no matchdetermination in Conwell; is that right?A. If there is no absolutely no entry
2 3 4	Excuse me. Q. Conwell can look at a reference work that is a near match to a query work, if the two map to the same hash value, correct?	2 3 4	hashes will result in a no matchdetermination in Conwell; is that right?A. If there is no absolutely no entryin the database that has exactly the same
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$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ 23\\ \end{array}$	Excuse me. Q. Conwell can look at a reference work that is a near match to a query work, if the two map to the same hash value, correct? A. By using appropriately designing hash functions, yes. Q. So in the Conwell system, a determination is made as to whether two works match by comparing whether their hash values are exact matches? A. Can you repeat the question again? Q. Conwell determines whether two works match by comparing whether their hash values are exact matches, correct? A. That is correct. MR. NEMEC: Can I take a quick five minutes? I apologize. MR. LUNER: Sure. THE VIDEOGRAPHER: The time is 3:43. We're going off the record. (A brief recess was taken.) THE VIDEOGRAPHER: The time is 3:53. We're now back on the record.	$\begin{array}{c} 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ 23\\ \end{array}$	 hashes will result in a no match determination in Conwell; is that right? A. If there is no absolutely no entry in the database that has exactly the same hash value as that computed for the query, it will have no match. Q. Generally speaking, would you consider a search of a dictionary, a paper dictionary, to be a non-exhaustive search? MR. LUNER: Objection to form. A. What do you mean by a search of a dictionary, of a paper dictionary? Q. Looking up a word in the dictionary. MR. LUNER: Objection to form. A. That would depend on how you go about doing that. Q. So what are the different ways that one might look up a word in the dictionary? A. Well, one way to do that is start from page 1 and go down until you find the page on which that word occurs, or go to the end of the dictionary. That would one way to
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	Excuse me. Q. Conwell can look at a reference work that is a near match to a query work, if the two map to the same hash value, correct? A. By using appropriately designing hash functions, yes. Q. So in the Conwell system, a determination is made as to whether two works match by comparing whether their hash values are exact matches? A. Can you repeat the question again? Q. Conwell determines whether two works match by comparing whether their hash values are exact matches, correct? A. That is correct. MR. NEMEC: Can I take a quick five minutes? I apologize. MR. LUNER: Sure. THE VIDEOGRAPHER: The time is 3:43. We're going off the record. (A brief recess was taken.) THE VIDEOGRAPHER: The time is	$2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ 21 \\ 22 $	 hashes will result in a no match determination in Conwell; is that right? A. If there is no absolutely no entry in the database that has exactly the same hash value as that computed for the query, it will have no match. Q. Generally speaking, would you consider a search of a dictionary, a paper dictionary, to be a non-exhaustive search? MR. LUNER: Objection to form. A. What do you mean by a search of a dictionary, of a paper dictionary? Q. Looking up a word in the dictionary. MR. LUNER: Objection to form. A. That would depend on how you go about doing that. Q. So what are the different ways that one might look up a word in the dictionary? A. Well, one way to do that is start from page 1 and go down until you find the page on which that word occurs, or go to the

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Page 1821know, if the dictionary is alphabetized, to2go to the set of pages that starts with the3same character as your word and then go down4that list until you find something.5Q. And would either of those searches6be a non-exhaustive search?7A. So the second way in which you8directly go to the pages that, let's say9start with, your word starts with a K, you do10not examine any pages prior to the one that11start with the K, you know, that would be a12non-exhaustive search.13The first way is not.14Q. Is that why15MR. NEMEC: Strike that.16Q. In the paper dictionary example17that we're discussing, the words are arranged18in alphabetical order before your lookup19process begins, correct?20A. Thet incurve the twe why mage he do	er the ould ype of ly create hose ered ning. tte an te is you base that
2go to the set of pages that starts with the 32electronic database, would you ord entries in some fashion?4that list until you find something.3entries in some fashion?4that list until you find something.4A. If I have a database and I w like to be able to perform certain ty queries efficiently, I would probably indices that would allow me to do to efficiently.7A. So the second way in which you 86indices that would allow me to do to efficiently.9start with, your word starts with a K, you do 109Q. So you would create an ord database, in other words?11start with the K, you know, that would be a 1211A. Actually, there is no such th 1213The first way is not.13The first way is not.1414Q. Is that why 1514Q. In the paper dictionary example 1716order that is up to modify the inqui 1717that we're discussing, the words are arranged 18in alphabetical order before your lookup17Q. Okay. In general, the purper oreating such an index would be to 1919process begins, correct?19search more efficient?	er the ould ype of ly create hose ered ning. tte an te is you base that
3same character as your word and then go down3entries in some fashion?4that list until you find something.4A. If I have a database and I w5Q. And would either of those searches5like to be able to perform certain ty6be a non-exhaustive search?6queries efficiently, I would probably7A. So the second way in which you7indices that would allow me to do to8directly go to the pages that, let's say8efficiently.9start with, your word starts with a K, you do9Q. So you would create an ord10not examine any pages prior to the one that10database, in other words?11start with the K, you know, that would be a11A. Actually, there is no such th12non-exhaustive search.12This is you don't necessarily creat13The first way is not.13order database. No, what you creat14Q. Is that why14create an index on top of your data15MR. NEMEC: Strike that.15order that is up to modify the inqui17that we're discussing, the words are arranged17Q. Okay. In general, the purpor18in alphabetical order before your lookup19process begins, correct?1919search more efficient?19search more efficient?	ould ype of ly create hose ered hing. tte an tte an te is you base that
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 8 directly go to the pages that, let's say 9 start with, your word starts with a K, you do 10 not examine any pages prior to the one that 11 start with the K, you know, that would be a 12 non-exhaustive search. 13 The first way is not. 14 Q. Is that why 15 MR. NEMEC: Strike that. 16 Q. In the paper dictionary example 17 that we're discussing, the words are arranged 18 in alphabetical order before your lookup 19 process begins, correct? 8 efficiently. 9 Q. So you would create an ord 10 database, in other words? 11 A. Actually, there is no such the 12 This is you don't necessarily creation order database. No, what you creation order database. No, what you creation order database. No, what you creation order that is up to modify the inquition order that is up to modify the	ered hing. hte an te is you base that
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10not examine any pages prior to the one that10database, in other words?11start with the K, you know, that would be a11A. Actually, there is no such th12non-exhaustive search.11A. Actually, there is no such th13The first way is not.12This is you don't necessarily creat14Q. Is that why14create an index on top of your data15MR. NEMEC: Strike that.15will allow you to, to transverse it in16Q. In the paper dictionary example16order that is up to modify the inquit17that we're discussing, the words are arranged17Q. Okay. In general, the purpor18in alphabetical order before your lookup18creating such an index would be to19process begins, correct?19search more efficient?	hing. hte an te is you base that
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18in alphabetical order before your lookup18creating such an index would be to19process begins, correct?19search more efficient?	
19process begins, correct?19search more efficient?	
	make the
20 A. That would be the way why people do 20 A. That is the purpose of most	
21it.21indexes, yes.22Q. So if someone asked you to go look22Q. Now, in Conwell, the reference	
23 up a word in the dictionary, which of the two 23 table as disclosed has its entries source 24 hash subrance 24 hash subrance 24	ted by
 approaches that you just described would you hash value, correct? use? A. Can you tell me which figure 	"
25use?25A. Can you tell me which figure	e you le
Page 183	Page 185
1MR. LUNER: Objection to form.1referring to?2A. Well, I will do another approach2Q. Sure. I'm referring actually	to
	101.
	intion
	-
6 contain the words that start with the same 6 the present disclosure assumes the	entries
6 contain the words that start with the same 6 the present disclosure assumes the 7 character as my guard by identifier "	n ? I'm
7 character as my query. 7 are sorted by identifier."	11 (1 III
7character as my query.7are sorted by identifier."8Q. And that's the approach that you8A. Yep. What was the question	
7character as my query.7are sorted by identifier."8Q. And that's the approach that you8A. Yep. What was the question9characterized as non-exhaustive, correct?9sorry.	
 7 character as my query. 8 Q. And that's the approach that you 9 characterized as non-exhaustive, correct? 10 A. That would be the one I 7 are sorted by identifier." 8 A. Yep. What was the question 9 sorry. 10 Q. So do you understand from 	that that
 7 character as my query. 8 Q. And that's the approach that you 9 characterized as non-exhaustive, correct? 10 A. That would be the one I 11 characterized, yes. 7 are sorted by identifier." 8 A. Yep. What was the question 9 sorry. 10 Q. So do you understand from 11 the disclosure here is of a reference 	that that table
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 7 character as my query. 8 Q. And that's the approach that you 9 characterized as non-exhaustive, correct? 10 A. That would be the one I 11 characterized, yes. 12 Q. Now if we're talking about an 13 electronic dictionary, would a search of an 7 are sorted by identifier." 8 A. Yep. What was the question 9 sorry. 10 Q. So do you understand from 11 the disclosure here is of a reference 12 with entries sorted by their hash van 13 A. Yes, I believe that's how the 	that that table lue?
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7character as my query.7are sorted by identifier."8Q. And that's the approach that you8A. Yep. What was the question9characterized as non-exhaustive, correct?9sorry.10A. That would be the one I10Q. So do you understand from11characterized, yes.10Q. So do you understand from12Q. Now if we're talking about an12with entries sorted by their hash va13electronic dictionary, would a search of an13A. Yes, I believe that's how the14electronic dictionary to look up a word use a14them sorted, yes.15binary search?15Q. And what is the purpose of16A. What do you mean by "electronic16the hash entries?17dictionary"?17A. So one of the reasons that y18Q. So as opposed to a paper18to sort the hash entries is so that it to19dictionary, a collection of words and their19allow you to potentially implement20A. Without any more information, I22Q. In the fashion that you wou	that that table lue? ey have sorting ou like will a search ld, in a
7character as my query.7are sorted by identifier."8Q. And that's the approach that you9characterized as non-exhaustive, correct?99characterized as non-exhaustive, correct?9sorry.10A. That would be the one I10Q. So do you understand from11characterized, yes.11the disclosure here is of a reference12Q. Now if we're talking about an12with entries sorted by their hash va13electronic dictionary, would a search of an13A. Yes, I believe that's how that14electronic dictionary to look up a word use a14them sorted, yes.15binary search?15Q. And what is the purpose of16A. What do you mean by "electronic16the hash entries?17dictionary"?17A. So one of the reasons that y18Q. So as opposed to a paper18to sort the hash entries is so that it y20associated definitions arranged in a20efficiently.21database.21Q. In the fashion that you wou22A. Without any more information, I23will just go from record one until I find a23will just go from record one until I find a23letter in the word?	that that e table lue? ey have sorting ou like will a search ld, in a y its first
7character as my query.7are sorted by identifier."8Q. And that's the approach that you8A. Yep. What was the question9characterized as non-exhaustive, correct?9sorry.10A. That would be the one I10Q. So do you understand from11characterized, yes.11the disclosure here is of a reference12Q. Now if we're talking about an12with entries sorted by their hash va13electronic dictionary, would a search of an13A. Yes, I believe that's how the14electronic dictionary to look up a word use a14them sorted, yes.15binary search?15Q. And what is the purpose of16A. What do you mean by "electronic16the hash entries?17dictionary"?17A. So one of the reasons that y18Q. So as opposed to a paper18to sort the hash entries is so that it the19dictionary, a collection of words and their19allow you to potentially implement20associated definitions arranged in a20In the fashion that you wou21A. Without any more information, I22paper dictionary, look up a word by	that that e table lue? ey have sorting ou like will a search ld, in a y its first rm.

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Karypis

		J P10	
	Page 186		Page 188
1	increasing or decreasing order, right? Now I	1	which point in time the querying processing
2	would like to match a key, and if I want to	2	engine can make a decision on whether or not
3	leverage the track of how those things are	3	that would be more efficient or not, to use
4	sorted, I will do a, probably a binary	4	the indices or not.
5	search.	5	Q. If you made the decision that it
6	Q. A binary search being an example of	6	would be more efficient to use the indices,
7	a non-exhaustive search, correct?	7	that you would be using a non-exhaustive
8	A. That is correct.	8	search, correct?
9	Q. Now, lines 58 to 59 of Conwell in	9	A. So if the indices were enabled,
10	the same column there, column 5, it says,	10	then during querying processing time, the
11	"Maintenance to the table 12 is well	11	database engine would make a decision whether
12	understood by those skilled in data	12	or not answering that query would be faster
13	structures."	13	relying on the indices or not. And if it's
14	Do you see that?	14	faster, will use the indices; if it's not
15	A. Yes, I do.	15	faster, it will not.
16	Q. And as of about 2000, you think a	16	Q. I see.
17	person skilled in the art of the Cox patents	17	(Discussion off the record.)
18	would have been familiar with database	18	Q. Take a look at Exhibit 4. It's the
19	structures?	19	'179 patent. Take a look at column 21,
20	A. Actually, it talks about data	20	please, lines 37 to 42.
21	structures, not database structures.	21	A. I'm sorry, what were the line
22	Q. Oh, I apologize, okay.	22	numbers again?
23	So I will ask that question again.	23	Q. Lines 37 to 42.
24	As of 2000 do think a person	24	A. Okay.
25	skilled in the art would be familiar with	25	Q. The passage that begins, "While
	Page 187		Page 189
1	data structures?	1	databases of this size"?
2	A. Yes.	2	A. Yes.
3	Q. And do you think that a person of	3	Q. Would you agree that here this
4	skill in the art implementing the invention	4	specification in the Cox patent is explaining
5	described in the Conwell patent would turn to	5	that databases that were known as of the date
6	some form of commercially available data	6	of invention look up entries without
7	structure software?	7	comparing a query to all reference items?
8	MR. LUNER: Objection to form.	8	MR. LUNER: Objection to form.
9	A. That can be a possibility, they can	9	A. Okay, so what was the question
10	use a commercially available software to	10	again?
11	build it.	11	Q. Would you agree that the
12			
	Q. As of 2000, are you familiar with	12	specification in the Cox patents here in
13	Q. As of 2000, are you familiar with any of the commercially available database	13	column 21 is explaining that the databases
13 14	Q. As of 2000, are you familiar with any of the commercially available database software that was on the market?	13 14	column 21 is explaining that the databases that were known as of the date of invention,
13 14 15	Q. As of 2000, are you familiar with any of the commercially available database software that was on the market?A. Both commercial and open source,	13 14 15	column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without
13 14 15 16	Q. As of 2000, are you familiar with any of the commercially available database software that was on the market?A. Both commercial and open source, yes.	13 14 15 16	column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items?
13 14 15 16 17	Q. As of 2000, are you familiar with any of the commercially available database software that was on the market?A. Both commercial and open source, yes.Q. And generally speaking, did such	13 14 15 16 17	column 21 is explaining that the databasesthat were known as of the date of invention,date of invention look up entries withoutcomparing a query to all reference items?A. So what it here describes,
13 14 15 16 17 18	Q. As of 2000, are you familiar with any of the commercially available database software that was on the market?A. Both commercial and open source, yes.Q. And generally speaking, did such database software employ exhaustive lookup	13 14 15 16 17 18	column 21 is explaining that the databasesthat were known as of the date of invention,date of invention look up entries withoutcomparing a query to all reference items?A. So what it here describes,describes that databases have the technology
13 14 15 16 17 18 19	Q. As of 2000, are you familiar with any of the commercially available database software that was on the market?A. Both commercial and open source, yes.Q. And generally speaking, did such database software employ exhaustive lookup techniques?	13 14 15 16 17 18 19	column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items?A. So what it here describes, describes that databases have the technology to do that.
13 14 15 16 17 18 19 20	 Q. As of 2000, are you familiar with any of the commercially available database software that was on the market? A. Both commercial and open source, yes. Q. And generally speaking, did such database software employ exhaustive lookup techniques? A. That would be a direct function on 	13 14 15 16 17 18 19 20	column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items?A. So what it here describes, describes that databases have the technology to do that.Q. So that was an understood approach
13 14 15 16 17 18 19 20 21	 Q. As of 2000, are you familiar with any of the commercially available database software that was on the market? A. Both commercial and open source, yes. Q. And generally speaking, did such database software employ exhaustive lookup techniques? A. That would be a direct function on how you choose to configure it. You set up a 	13 14 15 16 17 18 19 20 21	 column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items? A. So what it here describes, describes that databases have the technology to do that. Q. So that was an understood approach to database searching as of 2000 when this
13 14 15 16 17 18 19 20 21 22	 Q. As of 2000, are you familiar with any of the commercially available database software that was on the market? A. Both commercial and open source, yes. Q. And generally speaking, did such database software employ exhaustive lookup techniques? A. That would be a direct function on how you choose to configure it. You set up a database, without creating indices. That's 	13 14 15 16 17 18 19 20 21 22	 column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items? A. So what it here describes, describes that databases have the technology to do that. Q. So that was an understood approach to database searching as of 2000 when this patent was filed, correct?
13 14 15 16 17 18 19 20 21 22 23	 Q. As of 2000, are you familiar with any of the commercially available database software that was on the market? A. Both commercial and open source, yes. Q. And generally speaking, did such database software employ exhaustive lookup techniques? A. That would be a direct function on how you choose to configure it. You set up a database, without creating indices. That's the only way to answer the queries that you 	13 14 15 16 17 18 19 20 21 22 23	 column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items? A. So what it here describes, describes that databases have the technology to do that. Q. So that was an understood approach to database searching as of 2000 when this patent was filed, correct? A. So as I said before, if I'm using a
13 14 15 16 17 18 19 20 21 22 23 24	 Q. As of 2000, are you familiar with any of the commercially available database software that was on the market? A. Both commercial and open source, yes. Q. And generally speaking, did such database software employ exhaustive lookup techniques? A. That would be a direct function on how you choose to configure it. You set up a database, without creating indices. That's the only way to answer the queries that you want would be to add an exhaustive search. 	13 14 15 16 17 18 19 20 21 22 23 24	 column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items? A. So what it here describes, describes that databases have the technology to do that. Q. So that was an understood approach to database searching as of 2000 when this patent was filed, correct? A. So as I said before, if I'm using a database system and I would like to perform
13 14 15 16 17 18 19 20 21 22 23	 Q. As of 2000, are you familiar with any of the commercially available database software that was on the market? A. Both commercial and open source, yes. Q. And generally speaking, did such database software employ exhaustive lookup techniques? A. That would be a direct function on how you choose to configure it. You set up a database, without creating indices. That's the only way to answer the queries that you 	13 14 15 16 17 18 19 20 21 22 23	 column 21 is explaining that the databases that were known as of the date of invention, date of invention look up entries without comparing a query to all reference items? A. So what it here describes, describes that databases have the technology to do that. Q. So that was an understood approach to database searching as of 2000 when this patent was filed, correct? A. So as I said before, if I'm using a

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Karypis

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	Page 190	Page 192
1	those queries, then the database system is	1 CERTIFICATE
2	intelligent enough to select to use those	2 STATE OF NEW YORK)
3	indices, and that will to lead to a faster	3 : ss.
4	query execution time.	4 COUNTY OF NEW YORK)
5	Q. Thank you.	5
6	MR. NEMEC: Off the record again.	6 I, Jennifer Ocampo-Guzman, a
7	THE VIDEOGRAPHER: Sure.	7 Notary Public within and for the State of New
8	The time is 4:11. We're going off	8 York, do hereby certify:
9	the record.	9 That GEORGE KARYPIS, the witness
10	(A brief recess was taken.)	10 whose deposition is hereinbefore set forth,
11	THE VIDEOGRAPHER: The time is	11 was duly sworn and that such deposition is a
12	4:23. We're now back on the record.	12 true record of the testimony given by the
13	MR. NEMEC: Thank you, Dr. Karypis.	13 witness.
14	No further questions from petitioner.	14 I further certify that I am not
15	MR. LUNER: Patent owner, Network-1	15 related to any of the parties to this action
16	doesn't have any questions.	16 by blood or marriage, and that I am in no
17	THE VIDEOGRAPHER: Okay. Time is	17 way interested in the outcome of this
18	4:23. We're going off the record. This	18 matter.
19	is the end of disk number 4, and that	19 IN WITNESS WHEREOF, I have
20	concludes this deposition.	20 hereunto set my hand this 13th day of
21	(Time noted: 4:23 p.m.)	21 November 2015.
22	(Thie hoted: 1.20 plini.)	22 22
23		23 JENNIFER OCAMPO-GUZMAN, CRR, CLR
23		24 JENNIFER OCAMIFO-GOZMAN, CRR, CER
24		
23		25
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Toll Free: 800-227-8440 Fax: 973-629-1287 J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J			
 3 2015 5 To: Charles R. Macedo, Esq. 6 Case Nam: Network-1 Technologies, Inc. v. Google 7 Veritext Reference Number: 2183243 8 Witness: George Karypis Deposition Date: 11/12/2015 9 Dear Sir/Madam: 10 Interastive the transcript and note any changes or corrections on the included errate sheet, indicating the page, line number, change, and 11 review the transcript and note any changes or corrections on the included errate sheet, indicating the page, line number, change, and 12 the reason for the change. Have the witness' signature at the bottom of the sheet notarized except in California where they are signing 13 under penalty of perjury and forward the errata sheet back to us at the address shown above. 14 15 If the jurat is not returned within thirty days of your receipt of 16 this letter, the reading and signing will be deemed waived. 17 18 19 20 Sincerely, 21 Production Department 22 Production Department 23 Encl. 	2		
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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:
(A) to review the transcript or recording; and
(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY. THE ABOVE RULES ARE CURRENT AS OF SEPTEMBER 1, 2014. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION. Filed on Behalf of NETWORK-1 TECHNOLOGIES, INC.

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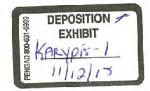
GOOGLE INC. Petitioner

V.,

NETWORK-1 TECHNOLOGIES Patent Owner

Cases IPR2015-00343, IPR2015-00345, IPR2015-00347, and IPR2015-00348 Patents 8,640,179, 8,205,237, 8,010,988, and 8,656,441

DECLARATION OF DR. GEORGE KARYPIS



NETWORK-1 EXHIBIT 2005 Google Inc. v. Network-1 Technologies, Inc. IPR2015-00343

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		1. non-exhaustive search (claim element 15(b))	169
		2. search identifying a neighbor (claim element 15(b))	186
		 determining an action based on the identification (claim element 15(c)). 	
	В.	'988 Ground 2: The instituted claims of the '998 patent are not obvious over Ghias	193
	Ċ.	*988 Ground 3: The instituted claims of the *998 patent are not anticipated by Iwamura.	194
		1. non-exhaustive search (claim 15(b))	
		2. identifying a neighbor (claim 15(b))	
VIII.	-175) patent	
	Α.	'179 Ground 1: The instituted claims of the '179 patent are not anticipated by Conwell.	
		1. neighbor search (claims 1, 13, 25).	
		2. non-exhaustive search (claims 1, 13, 25)	
	В.	*179 Ground 2: The instituted claims of the *179 Patent are not obvious in view of Ghias and Philyaw	
		1. non-exhaustive search (claims 1, 13, 25)	
		2. neighbor search (claims 1, 13, 25).	
IX.	•441	Patent.	
	Α.	'441 Ground 1: The instituted claims of the '441 Patent are not anticipated by Conwell.	
		1. neighbor search (claims 1, 13, 25)	
		2. non-exhaustive search (claims 1, 13, 25)	
	B.	'441 Ground 2: The instituted claims of the '441 Patent are not	
		obvious over Ghias and Philyaw.	
		1. non-exhaustive search (claims 1, 13, 25).	
		2. neighbor search (claims 1, 13, 25)	264

I, George Karypis, declare:

I am making this Declaration at the request of Patent Owner Network-1 Technologies, Inc. in the following *Inter Partes* Reviews of U.S. Patent Nos. 8,205,237 ('237 patent), 8,010,988 ('988 patent), 8,640,179 ('179 patent), and 8,656,441 ('441 patent) (collectively the "IPR Patents"):

- IPR2015-00345 (*237 patent),
- IPR2015-00347 (*988 patent),
- IPR2015-00343 (*179 patent), and
- IPR2015-00348 ('441 patent),

(collectively the "IPRs"), all initiated by petitioner Google Inc. ("Petitioner").

1. Background to my opinions in this Declaration.

A. Expertise.

1. I am a Professor in the Department of Computer Science and

Engineering at the University of Minnesota. I hold a Ph.D. in Computer Science from the University of Minnesota, granted in 1996. I began my post-graduate school career as a Research Associate in my current department. I became an Assistant Professor in 1999, an Associate Professor in 2004, and a Professor in 2009. I teach courses in Algorithms and Data Structures, Parallel Programming, and Data Mining, among other subjects.

2. I am a member of the Editorial Board of a number of academic journals, and I have chaired a number of academic conferences.¹ I am a co-author of the books *Introduction to Parallel Computing*, and *Introduction to Parallel Computing: Design and Analysis of Algorithms*. I am an author of more than 80 published journal papers, and more than 115 published conference papers.²

Representative academic conferences include:

- Program Committee co-Chair of the ACM Recommender Systems Conference (RecSys'13), Hong Kong, China (2013);
- Program Committee co-Chair of the 13th International Conference on Data Mining (ICDM), Dallas, Texas (December 2013); and
- Program Committee Co-Chair of the International Conference on Data Science and Advanced Analytics (DSAA 2014), Shanghai, China, (November 2014).
- Representative papers include:

2

 "L2Knng: Fast Exact K-Nearest Neighbor Graph Construction with L2-Norm Pruning" David C. Anastasiu and George Karypis, 24th ACM International Conference on Information and Knowledge Management (CIKM), Melbourne, Australia (2015).

3. I have also developed a number of software systems for a variety of functions, including software for analyzing high-dimensional data sets. A copy of my curriculum vitae is attached as <u>Exhibit A</u> to this Declaration. It contains a more complete listing of my professional activities and background.

B. Assignment.

4. I have been retained by Patent Owner Network-1 Technologies, Inc. as a technical consultant. I am being compensated for my time at my standard consulting rate of \$350 per hour. I am not receiving any compensation that depends on the outcome of the IPRs.

5. This declaration addresses the validity of:

- "L2AP: Fast Cosine Similarity Search with Prefix L-2 Norm Bounds" David Anastasiu and George Karypis, 30th IEEE International Conference on Data Engineering (ICDE), pp. 784—795 (2014).
- "Comparison of Descriptor Spaces for Chemical Compound Retrieval and Classification" Nikil Wale and George Karypis, IEEE International Conference on Data Mining (ICDM), pp. 678—689 (2006).
- "Empirical and Theoretical Comparisons of Selected Criterion Functions for Document Clustering" Ying Zhao and George Karypis, Machine Learning, 55, pp. 311-331 (2004).

- claims 1, 3-5, 7-9, 11-13, 15, 16, 21-27, 29, 30, 33, 34, 35, 37, and 38 of the '237 patent;
- claims 15-17, 21-28, 31-33, 51, and 52 of the '998 patent;
- claims 1-3, 6, 8–14, 18, 19, 21–27, 29–31, and 34–37 of the '179 patent; and
- claims 1-3, 6, 8-14, 18, 19, 21-27, 29, and 30 of the '441 patent.

C. Approach.

- To develop my opinions, I have read:
- the four IPR Patents (the '237, '988, '179, and '441 patents);
- · the four Petitions for Inter Partes Reviews;
- the exhibits accompanying the Petitions, including the four Declarations of Dr. Pierre Moulin (Exs. 1004 in each IPR);
- · the four Decisions Instituting the IPRs; and
- the testimony of Dr. Pierre Moulin, dated August 19-20, 2015 (Ex. 2006).³

³ In this Declaration, I identify the specific Petition, Declaration, and Decision that I am citing by including the corresponding patent abbreviation in a parenthetical. For example, I refer to the Petition addressing the '237 patent as Pet. ('237) at X; and the Moulin Declaration addressing the '179 patent as Moulin Decl. ('179) ¶X. Because there is only one Dr. Moulin Deposition transcript for all

7. In addition, I relied on my personal knowledge and experience with both research and development in the technology underlying the IPR Patents and the art asserted against the IPR Patents.

D. Understanding of the law.

8. My understanding regarding the law as applicable to this Declaration is based on my discussions with counsel. I have included in the text of my Declaration quotations from or references to certain legal cases or statutes that were provided to me by counsel to provide me with an understanding of the relevant law.

E. Person of ordinary skill in the art.

9. Through my education, experience and training, in academia and industry, and my analysis of the IPR Patents, I am familiar with the knowledge of a person of ordinary skill in the field of the IPR Patents at the time of invention in 2000.

10. For the purposes of this Declaration, I am of the opinion that a person of ordinary skill in the art with respect to the IPR Patents is a person with a Bachelor's degree in computer science, mathematics, or a similar discipline and two to three years of relevant experience, or a graduate degree in the same area. four IPRs (Ex. 2006), I simply refer to Dr. Moulin's deposition testimony as Moulin Depo. Z.

In determining what would be the level of ordinary skill in the field as of the 2000 time frame, I considered the following:

- (a) the educational level of the inventor, Ingemar J. Cox (it is my understanding that Dr. Cox has a bachelor's degree in electronics and computer science from University College London (1980) and a Ph.D. from Oxford (1983));
- (b) the type of problems encountered in the art—*i.e.*, how to identify a digital work without modifying the work (*see e.g.*, '237, 1:30-36);
- (c) the prior art solutions to those problems (see e.g., '237, 1:37-4:4, and the prior art asserted by the Petitioner in the IPRs addressing related problems involving searching, matching, and identifying melodies, audio files, and other digital files within databases—Conwell, Ghias, Iwamura, Chen, and Philyaw);
- (d) the rapidity with which innovations are made (based on my observations over the past 20 plus years, major innovations in content identification occur about every 5 to 10 years);
- (e) the sophistication of the technology (developing content identification solutions is a moderately sophisticated technology); and

(f) the educational level of workers in the field (workers in the field generally had have at least a bachelor's degree in computer science, mathematics or a similar discipline and at least two to three years of relevant experience).

11. Based on these factors, it is my conclusion that a person of ordinary skill in the art at the time would have been a person with a Bachelor's degree in computer science, mathematics, or a similar discipline and two to three years of relevant experience, or a graduate degree in the same or related area.

12. I note that Dr. Moulin suggests that the person of ordinary skill in the art "would have been highly skilled, and typically would have possessed at least an M.S. in computer science, electrical engineering, or mathematics; knowledge of video and audio processing techniques; and 1-2 years of experience in audio, video, or image processing." *See e.g.*, Moulin Decl. (*237) ¶7; Pet. (*237) at 4. Dr. Moulin's opinion as to the person of ordinary skill in the art is similar to mine with respect to the degrees and years of experience, but I note that: (1) Dr. Moulin does not provide any rational underpinnings for his opinion; and (2) the phrase "highly skilled" used by Dr. Moulin in his description is a relative term and Dr. Moulin does not provide the context for this phrase.

- II. Summary of the IPR Patents and asserted art.
 - 13. In this Declaration:
 - I use the term "work" to mean the item (e.g., a digital audio or image file) to be identified using the search (see e.g., '237, 6:51-56; '988, 7:17-20; '179, 6:18-21; '441, 6:49-52);
 - I use the term "record" to mean one of the units in the reference database that the extracted features of the work may be compared to (*see e.g.*, '237, 6:16-20; '988, 6:46-50; '179, 6:21-24; '441, 6:15-18); and
 - I use the term "database," "data set," or "library" to mean the collection of all records to be searched (*see e.g.*, *237, 6:23-30; *988, 6:50-60; *179, 6:30-36; *441, 6:24-30).

A. The IPR Patents.

14. Each IPR Patent (the *237, *179, *988, and *441 patents) involves a search that compares features from a given work to records in a reference database of potential matches to identify an action to be taken.

237 patent (Ex. 1001 '237 IPR).

15. The independent claims of the '237 patent include the following elements:

[1] receiving or obtaining features extracted from a work;

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[2] identifying the work using the extracted features to perform a search of

the database, where the search is:

- a sub-linear time search to identify a neighbor (claims 1 and 5);
- an approximate nearest neighbor search (claims 9 and 13);
- · a non-exhaustive search ... to identify a near neighbor (claim 25); or
- · a sublinear approximate nearest neighbor search (claim 33); and

[3] either (i) transmitting information about the identified work to the client

device, or (ii) determining an action based on the identity of the work.

16. The invention claimed in the '237 patent includes two key features:

17. Feature 1: Although the language varies among the claims, each

claim requires that the "identifying" be performed based on a search that has two properties:

- a sub-linear or non-exhaustive property (reflected in the underlined language):
 - <u>sub-linear</u> time search ... to identify a neighbor (claims 1 and 5);
 - approximate nearest neighbor search (claims 9 and 13);
 - non-exhaustive search ... to identify a near neighbor (claim 25); and
 - sublinear approximate nearest neighbor search (claim 33).

(2) a neighbor property (reflected in the underlined language):

- identify a <u>neighbor</u> (claims 1 and 5):
- approximate nearest <u>neighbor</u> search (claims 9 and 13);
- non-exhaustive search ... to identify a near neighbor (claim 25); and
- sublinear approximate nearest neighbor search (claim 33).

18. <u>Feature 2</u>: The system must either determine an "action" based on the identification (claims 25 and 33); or transmit information about the identified media work to a "client device" (claims 1, 5, 9, and 13). It is not sufficient to simply identify a match. Rather, an action must also be identified or information about the identified work must be transmitted to the client device.

2. '988 patent (Ex. 1001 '988 IPR).

The independent claims of the '988 patent include the following elements:

- [1] extracting features from a work;
- [2] identifying the work based on the extracted features by performing "a non-exhaustive search identifying a neighbor;"
- [3] determining an action based on the identity of the work; and
- [4] performing the action.

20. The invention claimed in the '988 patent includes two relevant distinguishing features:

 the "identifying" must be performed using a "non-exhaustive search identifying a neighbor;" and

(2) the system must "determin[e] an action" and "perform[] the action" based on the identity of the work. It is not sufficient to identify a match. Rather, "an action" associated with the match must be "determin[ed]" and "perform[ed]." '988, claim 15.

21. I note that the Board did not institute trial for independent claim 1 of the '988 patent and any claims dependent on claim 1. Accordingly, I do not address these claims in this Declaration.

3. '179 patent (Ex. 1001 '179 IPR).

22. The independent claims of the '179 patent (claims 1, 13, and 25) include the following five elements for identifying a work and performing a corresponding action:

- a database comprising: (a) electronic representations of works; and (b) electronic data related to an action corresponding to works;
- [2] obtaining extracted features of an unknown work;
- [3] identifying the unknown work by comparing the extracted features and electronic representations using a "non-exhaustive neighbor search;"

[4] determining an appropriate action based on the electronic data related to

an action; and

[5] associating the determined action with the identified work.

'179, claims 1, 13, and 25.

23. The claimed steps are illustrated in Figure 1:

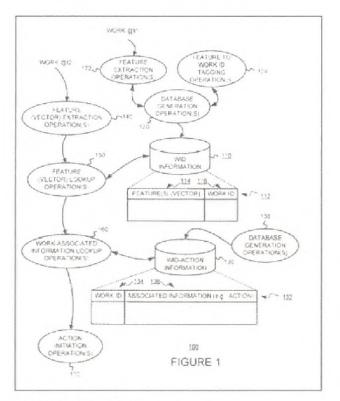


Figure 1 illustrates ("for work @t2"):

• "feature (vector) extraction operation(s)" (140) that extract features from the

work (*179, 6:45-47);

- "feature (vector) lookup operation(s)" (150) that identify the work by searching for a matching feature vector (*179, 6:50-52);
- "work-associated information lookup operation(s)" (160) that retrieve(s) associated information, such as an action ('179, 6:55-58); and
- "action initiation operation(s)" (170) that perform(s) some action based on the associated information ('179, 6:58-60).
- 24. The invention claimed in the '179 patent includes two relevant distinguishing features:
 - (1) the "identifying" must be performed by comparing the extracted features to the electronic representations using a "non-exhaustive neighbor search:" and
 - (2) the system must determine or associate an "action" based on the identified work. It is not sufficient to simply identify a match. Rather, "an action" associated with the match must be "determined" or "associated."

'179, claims 1, 13, and 25.

4. '441 patent (Ex. 1001 '441 IPR).

25. The independent claims of the '441 patent (claims 1, 13, and 25) include the following five elements for identifying a work and performing a

corresponding action:

[1] a database with (a) first data related to records, and (b) second data

related to action information corresponding to the records;

- [2] extracting features from a work;
- [3] identifying the work by comparing the extracted features and the data related to the records using "a non-exhaustive neighbor search;"
- [4] determining an action based on the identity of the electronic work; and
- [5] performing the action.

'441, claims 1, 13, and 25.

26. The claimed steps are illustrated in Figure 1:

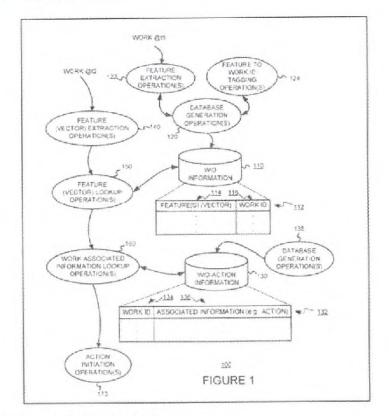


Figure 1 illustrates ("for work @t2"):

- "feature (vector) extraction operation(s)" (140) that extract(s) features from the work ('441, 6:39-41);
- "feature (vector) lookup operation(s)" (150) that identify the work by searching for a matching feature vector ('441, 6:44-48);
- "work-associated information lookup operation(s)" (160) that retrieve(s) associated information, such as an action ('441, 6:49-51); and
- "action initiation operation(s)" (170) that perform(s) some action based on the associated information ('441, 6:52-54).

27. The invention claimed in the '441 patent includes two relevant distinguishing features:

- the "identifying" must be performed by comparing the extracted features to the electronic representations using a "non-exhaustive neighbor search;" and
- (2) the system must determine or associate an "action" based on the identified work. It is not sufficient to simply identify a match. Rather, "an action" associated with the match must be "determined" or "associated."

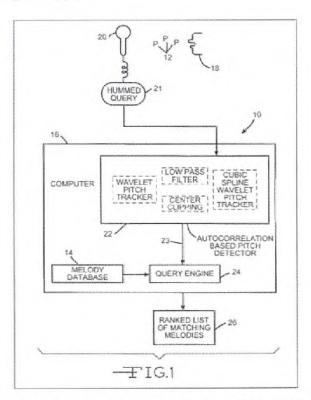
'441, claims 1, 13, and 25.

B. The asserted art.

28. The four IPRs address three primary references and two secondary references. I address each reference in turn, starting with the primary references and then turning to the secondary references.

Overview of Ghias—Ex. 1010 (addressed in the '237, '988, '179, and '441 IPRs).

29. Ghias (Patent No. 5,874,686) discloses "an apparatus [for] searching melodies." Ghias, Abstract. As illustrated in Figure 1 of Ghias, a "tune 12 is hummed by a person 18 into a microphone 20." Ghias, 2:41-42.



The data from the microphone is fed into "a pitch tracking module 22 in computer 16" which extracts "a contour representation" of the melody (23). Ghias, 2:41-50. The computer uses a "query engine 24" which "searches the melody database 14." Ghias, 2:50-52. The disclosed search can produce a ranked list of matching melodies—"ranked by how well they matched the query" (Ghias, 6:60-63) as illustrated at 26.

30. As I explain below in detail, all searches disclosed in Ghias are linear (not sub-linear) with respect to the size of the data set being searched. In addressing "the problem of approximate string matching," Ghias identifies the running times of several algorithms:

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Several Algorithms have been developed that address the problem of approximate string matching. Running times 25 have ranged from 0(mm) for the brute force algorithm to 0(km) or 0(nlog(m), where "0" means "on the order of," m is the number of pitch differences in the query, and n is the size of the string (song).

Ghias, 6:23-28. In each identified instance, the running time of the search is not sub-linear with respect to the data set. As clarified in this passage from Ghias (and as I address in detail below):

- "m is the number of pitch differences in the query" corresponding to the length of the query (highlighted in green in the passage above); and
- "n is the size of the string (song)" corresponding to the size of a record being searched (highlighted in orange in the passage above).

31. The disclosed searches may be sub-linear with respect to the length of the query being searched "m ... the number of pitch differences in the query." Specifically, the referenced search with a running time of O(nlog(m)) is sublinear with respect to "m" because it is a function of log(m)). The disclosed searches, however, are never sub-linear with respect to "n...the size of the string (song)" or the size of the data set (N) (*i.e.*, the number of songs to be compared). Rather, the search time will grow linearly with each additional song to be searched and the length of the song.

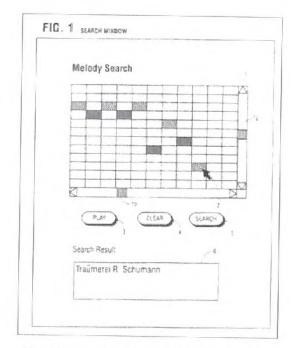
32. Also as I describe in detail below, the searches disclosed in Ghias are exhaustive rather than "nonexhaustive." The "query engine 24" compares the

work (user input 23) to "all the songs" in the melody database 14 (the library). Ghias, 5:66-6:2. After searching all possible matches, the system "output[s] a ranked list of approximately matching melodies." Ghias, 2:50-53.

33. Finally, as I describe in detail below, the searches disclosed in Ghias are not "neighbor" searches because the searches always necessarily identify the exact or closest match—they are guaranteed to identify an exact match or the closest match. Ghias does not identify any search in which an exact or the closest match is not guaranteed to be identified.

2. Overview of Iwamura—Ex. 1012 (addressed in the '237 and '988 IPRs).

34. Iwamura (Patent No. 6,188,010) discloses a "method to enable one to search for a song title when only its melody is known." Iwamura, Abstract. "A remote music database with melody information is searched for the melody entered by the user, using for example, a peak or differential matching algorithm." Iwamura, Abstract. Figure 1 illustrates "an example of a search interface" (Iwamura, 2:45-46):



35. Iwamura discloses a searching algorithm that is designed to be more efficient than alternatives by matching up peak notes from the work to be identified with the peak notes of the records in the database when comparing the notes from the work to be identified with the notes in the records. "Peak notes are also detected and marked when the data base is built." Iwamura, 6:59-60. "A fast search is performed by using a peak or differential matching algorithm." Iwamura, 12:1-2.

36. As I explain in detail below, the search disclosed in Iwamura is exhaustive rather than the claimed "non-exhaustive," "sublinear," or "approximate nearest neighbor" search. While the individual comparisons of a work and a record in the library can be more efficient using the "peak note" approach

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disclosed in Iwamura (search speed can be increased), in doing so each record in the library is searched as part of the disclosed algorithm and "[t]he reference melody that gives the least difference is returned as a search result." Iwamura, 7:53-55.

37. Moreover, the Boyer-Moore algorithm referenced in Iwamura searches "word by word from the beginning of the database to the end." Iwamura, 9:51-55. As a result, as I explain in detail below, while the Boyer-Moore algorithm may be sublinear with respect to the length of the query (the work to be identified),⁴ it is not sub-linear with respect to the relevant size of the dataset being searched.

⁴ If the query pre-processing step of the Boyer-Moore algorithm is included as part of the execution time, then the algorithm may be linear in terms of the length of the query. If the query is used repeatedly, however, the pre-processing execution time will only be incurred once. One can think of concatenating all the database strings to give as an aggregate length of n. If "m" is the query length, then the worse-case complexity is Theta(m) O(n), which is linear with respect to both the database n and the query length m.

Overview of Conwell—Ex. 1009 (addressed in the '179 and '441 IPRs).

38. Conwell (Patent No. 6,970,866) discloses associating media content,

such as MP3 files, with identifiers and URLs. Conwell, Abstract. As illustrated in Figure 3, the identifiers (*e.g.*, "034") are associated with corresponding URLs (*e.g.*, "<u>www.sonymusic.com/catalog/05634.html</u>"):

	www.sonymusic.com/catalog/05634.html
112	www.sonymusic.com/catalog/00014.html
198	www.supertracks.com/index/artists/taylor.htm
376	www.emusic.com/0555353x.pdf
597	www.cdw.com/music/featured_CDs/index.html
512	www.sonymusic.com/catalog/00231.html
850	www.polygram.com/franklin/adf_234 htm
921	www.loudeye.com/rap/1999/46755645.html
IG. 3	

39. Conwell discloses two approaches to identifying a work: (1)

assigning identifiers, or (2) implicitly generating identifiers derived from the data using a hashing algorithm. Conwell, Abstract. The implicit approach (rather than explicitly assigning identifiers) is the approach relevant to the IPR Petitions. *See* Pet. (*179) at 22-23.

40. Conwell relies on hashing algorithms to extract features from the work to be identified:

"The identifiers can be assigned, or can be implicit (*e.g.*, derived from other data in the content object, as by hashing)."

Conwell, Abstract; 1:65-67 ("some or all of the content data is processed by a hashing algorithm to yield a 128 bit identifier corresponding to that content.") As I explain in detail below, Conwell compares the hashed extracted features of the work to be identified to the features of the records in the database exclusively using an exact match comparison.

41. When implementing the search in Conwell to identify a match, comparing the hashed extracted features from a work with a record in the library using the disclosed lookup table (Conwell, 3:43-45) produces a binary result: either (1) there is an exact match; or (2) there is no exact match. *See* Conwell, Figure 3. Whether the hash of the extracted features of the work and the hashed extracted features of the record being compared are close (similar) or distant (dissimilar) is not considered, is not relevant, and cannot be determined using a nearness comparison of the hashes extracted in Conwell.

42. In addition, as I explain below in detail, while Conwell discloses using a sorted lookup table to store the hashed extracted features (*see* Conwell Figure 3, 3:43-45), Conwell does not identify any specific algorithm for performing the exact match comparison using the lookup-table and therefore does not identify either an exhaustive search or a non-exhaustive search. Either

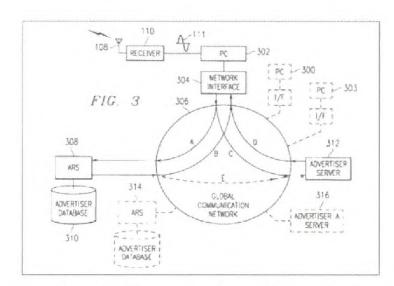
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approach could theoretically be used; however, neither approach is expressly or inherently disclosed.

Overview of Philyaw—Ex. 1014 (addressed in the '179 and '441 IPRs as a secondary reference).

Philyaw (Patent No. 6,098,106) discloses a system that uses

identifying information embedded into either the sound or video portion of a broadcast signal to view corresponding information. Philyaw, Abstract; 1:66-2:8. "Figure 3 illustrates the system interactions over a global network" (Philyaw, 2:20-21):



44. Rather than using the searches claimed in the IPR patents to identify a work by comparing extracted features to a database of potential matches, the system in Philyaw embeds a "routing signal having routing information contained therein" into a broadcast program to identify what is being broadcast:

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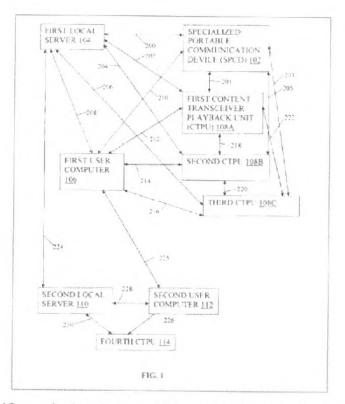
"A program is broadcasted having embedded therein a routing signal having routing information contained therein. The routing signal is then extracted from the broadcast. Thereafter, a personal computer is controlled to allow a user to retrieve the information from a storage region at the defined location, which defined location is located with the extracted routing information, providing it at the personal computer for use by the user."

Philyaw, 2:1-9. Accordingly, Philyaw does not disclose any searching algorithm.5

Overview of Chen—Ex. 1008 (addressed in the '237 IPR as a secondary reference).

45. Chen (Patent No. 7,444,353) discloses a system for identifying music in a "music and information delivery" system. Chen, Abstract. Figure 1 "illustrates one embodiment of a music and information delivery system according to the teachings" of Chen. Chen, 4:7-9.

⁵ I note that the '179 and '441 IPR Petitions do not assert that Philyaw discloses the claimed "non-exhaustive neighbor search" (from the '179 and '441 claims) but instead exclusively relies on Ghias for this element in Ground 2 of the '179 and '441 IPRs (the only grounds in which Philyaw is asserted). *See* Pet. ('179) 47-48, 51; Pet. ('441) 47-48; 51.



A user can identify music that they can then access, for example, by downloading to a laptop or home computer. Chen, 1:58-66.

46. The system in Chen can "search a storage medium to identify and access the piece of music from the storage medium." Chen, Abstract. But Chen does not provide any details as to how any search is performed. Accordingly, Chen does not disclose a(n):

- sub-linear time search to identify a neighbor (*237, claims 1 and 5);
- approximate nearest neighbor search ('237, claims 9 and 13);
- non-exhaustive search ... to identify a near neighbor ('237, claim 25); or

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• sublinear approximate nearest neighbor search (claim 33).

I note that neither the Petition nor the corresponding Declaration relies on Chen for these claimed elements but instead relies on Iwamura in Ground 3 of the '237 IPR, the only ground in which Chen is at issue. *See* Pet. ('237) at 54-57.

III. General Findings.

- 47. Based on my analysis of:
- (a) the IPR Patents (the '237, '988, '179, and '441 patents);
- (b) the art asserted against the IPR Patents in the four IPRs;
- (c) the IPR Petitions;
- (d) Dr. Moulin's Declarations (Exs. 1004 in each IPR) and deposition testimony (Ex. 2006);
- (e) the documents cited in the IPR Petitions;
- (f) the IPR Decisions; and
- (g) the other documents referenced in this Declaration,

I am of the opinion that the instituted claims of the IPR Patents⁶ are not unpatentable based on the grounds at issue in the IPRs.

⁶ I understand that the instituted claims are claims 1, 3–5, 7–9, 11–13, 15, 16,

^{21-27, 29, 30, 33, 34, 35, 37,} and 38 of the '237 patent; claims 15-17, 21-28, 31-

48. Specifically, for the reasons and based on the analysis that I set forth below, I am of the opinion that:

'237 patent:

- <u>Ground 1</u>: Claims 1, 3–5, 7–9, 11–13, 15, 16, 21–25, 29, 30, 33, 37, and 38 of the '237 patent are not anticipated by Iwamura under 35 U.S.C. § 102(e);
- <u>Ground 2</u>: Claims 1–3, 5–7, 9–11, 13–15, and 21–24 of the '237 patent are not anticipated by Ghias under 35 U.S.C. § 102(b);
- Ground 3: Claims 26, 27, 34, and 35 of the '237 patent are not obvious over Iwamura and Chen under 35 U.S.C. § 103;

'998 patent:

- Ground 1: Claims 15–17, 21–23, 28, 31, and 51 of the '998 patent are not anticipated by Ghias under 35 U.S.C. § 102(b);
- Ground 2: Claims 22, 24–26, and 52 of the '998 patent are not obvious over Ghias under 35 U.S.C. § 103(a);

33, 51, and 52 of the '998 patent; claims 1-3, 6, 8-14, 18, 19, 21-27, 29-31, and

34-37 of the '179 patent; and claims 1-3, 6, 8-14, 18, 19, 21-27, 29, and 30 of the '441 patent.

 Ground 3: Claims 15–17, 21, 23, 27, 28, 31–33, 38, and 51 of the '998 patent are not anticipated by Iwamura under 35 U.S.C. § 102(e);

*179 patent:

- Ground 1: Claims 1–3, 6, 8–14, 19, 21–26, 30, 31, and 34–37 of the '179 patent are not anticipated by Conwell under 35 U.S.C. § 102(e);
- <u>Ground 2</u>: Claims 1–3, 8, 10–14, 18, 19, 21–27, 29, 31, and 34–37 of the
 '179 patent are not obvious over Ghias and Philyaw under 35 U.S.C. § 103;

'441 patent:

- Ground 1: Claims 1–3, 6, 8–14, 19, 21–26, and 30 of the '441 patent are not anticipated by Conwell under 35 U.S.C. § 102(e); and
- Ground 2: Claims 1–3, 8, 10–14, 18, 19, 21–27, 29, and 30 of the '441
 patent are not obvious over Ghias and Philyaw under 35 U.S.C. § 103(a).

49. The information below presents the basis for my opinions that the challenged claims of the IPR Patents are not unpatentable based on the grounds at issue in the IPRs.

IV. General concerns with the IPR Petitions and Dr. Moulin's Declarations (Exs. 1004 in each IPR).

50. It is my understanding that a Petition must set forth how a challenged claim is to be construed. In addition, it is my understanding that a Petition and corresponding declaration must then map the properly construed claim language to the teachings of the asserted art. Based on my review of the Petitions and corresponding Declarations, one skilled in the art would understand that the Petitions and corresponding Declarations fail to comply with these requirements.

51. First, the Petitions (and in particular, the '237 Petition) and corresponding Declarations fail to identify any construction of the phrase "approximate nearest neighbor search." *See* Pet. ('237) at 1-53. Claims 9 and 13 of the '237 patent include an "approximate nearest neighbor search." *See* '237 patent claims 9 and 13. Because the Petition and Declarant do not identify any construction of "approximate nearest neighbor search," they fail to map the properly construed language to the teaching of the prior art (*i.e.*, Iwamura, Ghias, and Chen).

52. Second, although Petitioner and Dr. Moulin identified constructions for certain terms,⁷ neither the Petition nor the corresponding Declaration maps the construed claim language to the teachings of the asserted art.

53. Moreover, one skilled in the art would understand that Petitioner's failure to map the properly construed claim language to the teachings of the prior art results in critical mistakes in the IPR Petitions and Declarations, as I illustrate using the following two examples:

54. <u>Example 1</u>: In his Declaration with respect to the '237 patent, Petitioner's Declarant, Dr. Moulin, confirmed (consistent with my understanding and the understanding of one of ordinary skill in the art) that a "sublinear search" is a search that has a sublinear relationship to the database size:

53. I understand and agree with Petitioner's position that the term "sublinear search" means "a search whose execution time has a sublinear relationship to database size." For instance, a linear search of a 200-item database would take twice as long as a linear search of a 100-item database. By contrast, a sublinear search of a 200-item database would take less than twice as long as a sublinear search of a 100-item database, perhaps, for instance, 1.5 times as long.

Moulin Decl. (*237) ¶48 (addressing identify a neighbor / identify a near neighbor / nearest neighbor search); Moulin Decl. (*237) ¶53 (addressing sub-linear).

See, e.g., Moulin Decl. ('237) ¶43 (addressing non-exhaustive search);

Moulin Decl. (*237) ¶53. In that same Declaration, Dr. Moulin also asserted that Ghias discloses a search that is sublinear based on the disclosure in Ghias of algorithms that have running times of "O(kn) or O(nlog(m)):"

In particular, Ghias

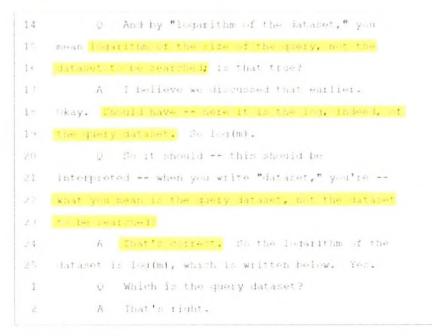
discloses searches whose execution times are proportional to the logarithm of the size of the data set (*id*) at 6/24-28 ("O(kn) or O(nlog(m)")), which, as explained above in Section V(D), are sublinear (Ex-1001 at 8:54-63).

Moulin Decl. (*237) ¶123.

55. In asserting that Ghias discloses a search that is sublinear, Dr. Moulin did not apply the construction of a sublinear search which requires that the search be sublinear with respect to the "size of the database" and not the number of pitch differences in the query which is the length of the query. Moulin Decl. (*237) ¶53. However, as stated in Ghias (and confirmed by Dr. Moulin at his deposition, *see* the deposition citations that I reference below), (1) "m" refers to the number of pitch differences in the query while "n" refers to the size of the string (song), and (2) each search algorithm identified in Ghias is linear with respect to the size of the data set. Accordingly, one skilled in the art would understand that Ghias does not disclose a sublinear search under Petitioner's (and Dr. Moulin's) own construction of sublinear.

56. Dr. Moulin's deposition transcript addressing the paragraph from his Declaration that I presented above (Moulin Decl. ('237) ¶123) demonstrates to one skilled in the art the problems that result from the Petitioner failing to apply Dr.

Moulin's own construction to the art:



Moulin Depo. 154:14-155:2

	$ \ \ \alpha \ , \ \ \alpha \ , \ \ , \ \ \alpha \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ , \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ , \ , \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ \ , \ , \ , \ $
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	t x if line 4.
÷	BY MR. DOVEL:
	0. Why do you object to writing it in there?
	A Why should i write it? I cust bail it.

Moulin Depo. 155:12-156:6.

1		A	Be.	tause	11'5 %	ery clear.	I'm saying the
2	weizid	"que	ry"	shoul	ld have	been incorp	porated before
З	"data	set.	**				

Moulin Depo. 156:22-157:3.

> Well, one possible reason you wanted to give the Board this information is so that they would misread it and be misled. 5 That's a possibility: right? 10 A It's not at all the -- the reason. So it alone == there are four documents. Some, they 1 I are, like, 90 pages each. Some of the words could 12 have been better chosen. In particular, the word 13 14 "guery" should have been there. I have acknowledged 15 that. ④ 특별한 초등등일법은 *** 10 A Again, I have acknowledged that this was 18 not written the best way.

Moulin Depo. 157:6-18.

57. Example 2: As I noted above, in his Declaration with respect to the

*237 Patent, Dr. Moulin confirmed that a sublinear search is a search that has a sublinear relationship to the database size:

53. 1 understand and agree with Petitioner's position that the term

"sublinear search" means "a search whose execution time has a sublinear

relationship to database size." For instance, a linear search of a 200-item database

Moulin Decl. ('237) ¶53. Just a few pages later in that same Declaration, Dr.

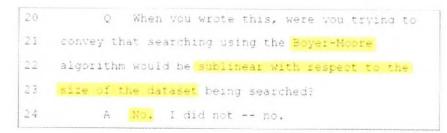
Moulin asserted:

72 — It is my opinion that Iwamira further teaches how this search can be sublinear. For example, Iwamira discloses that different "search algorithms may be applied to perform melody searches," (*id*: at 10.2-3), such as the "Boyer-Moore algorithm," (*id*: at 9.63). "On the average the [Boyer-Moore] algorithm has a sublinear behaviour," Ex: 1017 at 1

Moulin Decl. (*237) ¶72. In asserting that Iwamura discloses a search that is sublinear, Dr. Moulin did not apply his construction of a sublinear to the referenced Boyer-Moore algorithm.

58. As I explain in detail below and confirmed by Dr. Moulin, one skilled in the art would understand that the Boyer-Moore algorithm disclosed in Ghias does not disclose sublinear behaviors with respect to the size of the data set but only with respect to the query (or pattern)⁸ to be matched. Again, Dr. Moulin's deposition transcript addressing the paragraph from his Declaration that I presented above (Moulin Decl. ('237) ¶72) demonstrates to one skilled in the art the problems that result from Petitioner failing to apply Dr. Moulin's own construction to the art:

⁸ Dr. Moulin testified that "query," "pattern," and "probe" are "all synonymous in this context." Moulin Depo. 21:24-22:1. I agree with Dr. Moulin's testimony.



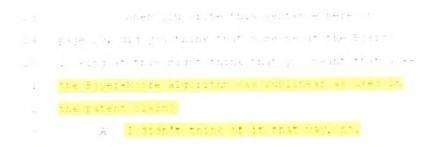
Moulin Depo. 74:20-24.

9	Q When we read paragraph 72, are you
10	conveying to the reader that the Boyer-Moore
11	algorithm is sublinear with respect to the size of
12	the dataset being searched?
13	A No. All I do is quote a part of a paper
14	that shows why that algorithm is much faster than
15	brute force. That's all I'm doing. You're
16	inferring things I'm not saying or writing.

Moulin Depo. 69:9-16.

9	Q When we read paragraph 72, are you
10	conveying to the reader that the Boyer-Moore
11	algorithm is sublinear with respect to the size of
12	the dataset being searched?
13	A No. All I do is quote a part of a paper
14	that shows why that algorithm is much faster than
15	brute force. That's all I'm doing. You're
16	inferring things I'm not saying or writing.

Moulin Depo. 66:9-18.



Moulin Depo. 75:23-76:3.

1~	4	And when y	yis siste	s this, were y	tu trying
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1.0	algerithm	is the the	at, if y	24 498 1°, 1°	s sublinear
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Moulin Depo. 67:17-21.

V. Claim Constructions.

59. In construing the claims of the IPR Patents, I understand that in this proceeding, the claims are interpreted using the broadest reasonable construction in light of the patent in which they appear. I also understand that there is a presumption that a claim term carries its ordinary and customary meaning to one of ordinary skill in the art at the time of the invention. In conducting my analysis of the claim elements below, I apply this understanding.

60. It is also my understanding that, for purposes of evaluating whether the IPR Petitions satisfied an initial threshold, the Board identified certain claim

> 38 Page 42 of 292

constructions in its Decisions. It is my understanding that the preliminary

constructions identified by the Board are:

"sub-linear"	"a search whose execution time scales with a less than linear relationship to the size of the data set to be searched"
	Decision (*237) at 7.
"non-exhaustive search" / "non- exhaustivesearch"	"a search that locates a match without a comparison of all possible matches"
	Decision ('237) at 7;
	Decision ('988) at 7;
	Decision (179) at 7; and
	Decision ('441) at 7.
"neighbor search" / "identifying a neighbor"	"identifying a close, but not necessarily exact or closest, match"
	Decision ('988) at 7;
	Decision (*179) at 8; and
	Decision ('441) at 7.
"neighbor" / "near neighbor"	"a close, but not necessarily exact or closest, match"
	Decision ('237) at 8.
"approximate nearest neighbor search"	"identifying a close match that is not necessarily the closest match"
	Decision ('237) at 9.

I address each construction in turn.

A. sub-linear (*237 patent).

61. The Board's preliminary construction of "sub-linear time search" is "a search whose execution time scales with a less than linear relationship to the size of the data set to be searched." Decision (*237) at 7. While the Board's preliminary construction is a correct construction of "sub-linear time search," there are apparently two possible interpretations of the Board's construction:

Interpretation 1: consistent with the meaning of the phrase "size of the data set," the "size of the data set" refers to the number of records in the data set being searched (such that the relevant linear relationship is with respect to the size of the data set, *i.e.*, the number of records in the data set), or Interpretation 2: the "size of the data set" refers to the length of an individual record in the database (such that the linear relationship is with respect to the length of an individual record to be searched rather than the size of the data set).

62. As I explain below, the first interpretation is correct. Also, as I demonstrate below, the asserted art for this element (Iwamura and Ghias) does not disclose a sub-linear search under either interpretation. The (1) words actually used in the Board's construction, the (2) specification of the '237 patent, and (3) the Petitioner's Declarant, confirm that the proper interpretation of a sub-linear search, in the context of the '237 patent, is a search that is sublinear with the size

40 Page 44 of 292

of the data set where the data set is the number of records in the database, not the length of an individual record in the data set.

the words used in the construction: "size of the dataset"

63. A data set, in the context of the '237, is a database (i.e., set of

records), not an individual record in a dataset or database. The Board incorporated the phrase "size of the dataset" in its preliminary construction based on the fact that "database" and "dataset" are "largely consistent" such that "database size" and "size of the data set" are "largely consistent." Decision ('237) at 7. As Petitioner's Declarant confirmed, "dataset" and "database" are the same in the context of the IPR Patents:

O When you say "database," is that the same 14 15 thing as "dataset" in this context? 16 A Ves.

Moulin Depo. 22:14-16.

	Q When you wrote "sublinear" here, you're
	referring to sublinear with respect to the size of
3	the dataset being searched?
4	A Yes. Okay. Just to be clear, the dataset
53	is the whole database, ckay, the database of songs.

Moulin Depo. 110:11-15. Consistent with the understanding of one skilled in the art, I agree with Petitioner's Declarant—that "database" and "dataset" are the same in the context of the IPR Patents.

64. A database comprises all records in the database: a single record in a database is not a database. My understanding is consistent with the testimony of Petitioner's Declarant:

11 St tust to make it clear, N is not the 11 size of the database: N is the size of a single 18 song.

Moulin Depo. 89:4-13.

65. Moreover, I observed that the origin of the phrase "data set" in the Board's construction of sub-liner is the Patent Owner's Preliminary Response for the '237 patent in which Patent Owner specifically clarified that the "size of the data set" is the number of potential matches in the data set (*i.e.*, the 'number of entries in the search database." Preliminary Response ('237) at 9-10 (*quoting* Moulin Decl. ('237) ¶54). I note that neither the Patent Owner (in its Preliminary Response) nor the Petitioner (in its Petition or Declaration) stated or suggested that sublinear should be based on the length of an individual query in the dataset.⁹

⁹ This is the natural growth mechanism for such a problem. For example, if there are X songs in a database and X additional songs are added, in one dimension the database has doubled (2X). In general, there is no reason to think that the distribution of record sizes changes as the size of the database (number of record in the database) increases. If each record is a fixed length vector, the database size

2. '237 specification.

66. As I noted above, it is my understanding that a claim in an unexpired patent is given its broadest reasonable construction in light of the specification of the patent in which it appears. It is also my understanding that the best source for discerning the proper context of claim terms is the patent specification.

67. "Sub-linear" indicates a relationship between two quantities which is less than linear. Linearity describes "[t]he relationship existing between two quantities when a change in a second quantity is directly proportionate to a change in the first quantity." Ex. 2007 (Modern Dictionary of Electronics) at 425 (1999). "Sub-" is a prefix indicating "under" or "below."

68. The claim language identifies "time" as one of the quantities being related. In the expression "a sub-linear time search," "sub-linear time" is an adjective phrase modifying "search." The '237 specification identifies the number of records in the data set ("N") as the variable that is sub-linear with respect to time.

will double when the number of records doubles. Even if each record is a digital representation of an entire song, there is no reason to think that the new songs have a time / length statistical distribution that is significantly different from the songs that already exist in the database.

69. First, the specification identifies a problem with prior art searches that the searches are "linear" with respect to the number of records in the data set ("N")¹⁰—not with respect to the length of an individual record in the database being searched:

"If binary search was possible, then a <u>database containing N vectors</u> would require at most log(N) comparisons. In previous work, it was not uncommon to perform <u>a linear search of all N entries</u>, perhaps halting the search when the first match is found. On average, this will r<u>equire N/2</u> <u>comparisons</u>.¹¹ If N is large, this search can be computationally very expensive."

·237, 8:54-63.12

¹⁰ In the '237 specification, the variable "N" indicates the number of entries in the database being searched—"a <u>database containing N vectors</u>." '237, 8:54–55.

¹¹ N/2 is the expected average result for an exhaustive or linear search of a dataset with one match.

¹² A search algorithm that requires N/2 comparisons has a running time that scales linearly with respect to N. As N increases by one, the search's running time increases by, on average, one half of the running time of a single comparison. Thus, as N increases, the running time of a search requiring N/2 comparisons increases by a directly proportionate amount, *i.e.*, linearly.

"Consider a situation in which one out of 100,000 possible commercials is to be identified. Each 30-second commercial consists of 900 video frames. If all 900 frames are stored in the database, then N=90,000,000. Even if only every 10th video frame is stored in the database, <u>its size is still nine million</u>. While databases of this size are now common, they rely of [sic] efficient search to access entries, i.e., they <u>do not perform a linear search</u>. A binary search of a <u>90,000,000-item database</u> requires less than 20 comparisons. <u>In</u> <u>contrast, a linear search</u> will require an average of 45,000,000!"

.237, 21:14-23.

70. In both of the instances from the '237 specification that I presented above, the '237 specification describes prior art search techniques as "linear" with respect to "N"—the number of records in the database being searched—not with respect to the length of an individual record in the database.

71. Second, the '237 specification identifies search techniques that achieve a sub-linear search time with respect to the number of records in the database being searched (not with respect to the length of an individual record being searched):

"Other forms of matching include those based on <u>clustering</u>, <u>kd-trees</u>, <u>vantage point trees and excluded middle vantage point forests</u> are possible and will be discussed in more detail later. . . . Thus, for example, a <u>sub-linear search time</u> can be achieved."

237, 8:64-9:7.

"A number of possible data structures are applicable including <u>kd-</u> <u>trees and vantage point trees</u>. These data structures and associated search algorithms organize <u>a N-point dataset</u> (N=90,000,000 in out previous example) so that <u>sub-linear time searches can be performed</u> on average."

*237, 21:56–60. Clustering, kd-trees, vantage point trees and excluded middle vantage point all achieve sub-linear behavior by reducing the number of records being search, *e.g.*, by discarding clusters (buckets) of potential matches, not by reducing the length of an individual record being searched. These methods prune parts of the search space (*i.e.*, data records to be searched) and this is why they are efficient.¹³

¹³ The Yianilos paper incorporated by reference into the '237 patent ('237, 8:65-9:6) explains: "We introduce the idea of aggressive pruning and give a family of practical algorithms, an idealized analysis, and describe experiments. Our main result is that search complexity measured in terms of *d*-dimensional inner product operations, is i) strongly sublinear with respect to the data set size *n* for moderate *R*, ii) asymptotically, and as a practical matter, independent of dimension." See Ex. 2010 (P. N. Yianilos) at 1.

72. Again, in all instances, the '237 specification describes techniques as "linear" with respect to "N"—the number of records in the database being searched—not with respect to the length of an individual record in the database.

3. Petitioner's Declarant.

73. According to Petitioner (consistent with the understanding of one skilled in the art), a "sublinear" search is "a search whose execution time has a sublinear relationship to database size"—where the database size is the number of records in the database, not the length of an individual record in the data set.

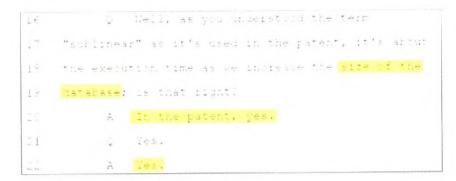
74. A "database" consists of all records in the data set; a "database" is not one individual record in the database—an individual record is not a "database." Dr. Moulin confirmed that sublinear in the context of the '237 patent is based on the size of database (a "concept that's common in [his] field" Moulin 8:10-14), not the length of an individual record in the database:

53. I understand and agree with Petitioner's position that the term "sublinear search" means "a search whose execution time has a sublinear relationship to database size." For instance, a linear search of a 200-item database would take twice as long as a linear search of a 100-item database. By contrast, a sublinear search of a 200-item database would take less than twice as long as a sublinear search of a 100-item database, perhaps, for instance, 1.5 times as long.

Moulin Decl. ('237) ¶53. As Petitioner's Declarant-Dr. Moulin-confirmed:

î. H	<pre>c And what it infers t</pre>	. to be more piellse.
28	is that if we have a sublinear	search, that reach
-	that the search time is 7 ind .	• 11 – 4• 1495 • 141 4
-	linear relationship compared t	the size of the
1	istalase as we increase the si	ze of the database?
÷	A Tost is correct.	

Moulin Depo. 13:24-14:4.

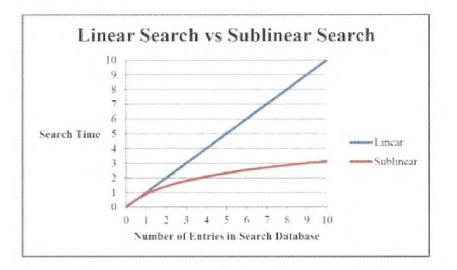


Moulin Depo. 103:16-22; 16:4-12; 24:1-12.

75. The Petition and corresponding Declaration interpreted "database size" as the number of records in the database (not the length of an individual record to be searched):

"For instance, a linear search of a 200-item database would take twice as long as a linear search of a 100-item database. By contrast, a sublinear search of a 200-item database would take less than twice as long as a sublinear search of a 100-item database, perhaps, for instance, 1.5 times as long."

Pet. (*237) at 6; Moulin Decl. (*237) ¶ 53.



Moulin Decl. ('237) ¶54 (showing that the execution time of a sub-linear time search increases with a less than linear relationship to the "number of entries in the search database").

"[I]t is my opinion that a search whose execution time is proportional to the logarithm of the size of the data set (e.g., a search with execution time proportional to A log (BN), where A and B are constants, and N is the number of entries in the database) is sublinear."

Moulin Decl. (*237) ¶56.

76. One skilled in the art would understand that each explanation of "sublinear" in the Petition and Declaration demonstrates that the sub-linearity of a search depends on the number of entries in a database, not on other factors, such as the length of an individual record in the database. Nowhere does Petitioner or the

Declarant suggest that the relevant sublinear search is with respect to the length of an individual record to be searched.¹⁴

77. I note that in its Decision, the Board did not present any analysis or reasoning for interpreting sub-linear relative to the length of an individual record being searched rather than the number of records in the dataset. *See* Pet. (*237) at 7. And the example presented by the Board in its Decision equates "data set" with the number of records in the database ("N"), not the length of an individual record:

One example of such a sub-linear search would be a search with an execution time proportional to the logarithm of the size of the data set ("N"), where a doubling of N would lead to an execution time proportional to log(2N).

¹⁴ In Petitioner's analysis, the length of individual records is not a factor in evaluating whether an algorithm is a sub-linear time search or a linear time search. If the length of individual records were a factor in evaluating the sub-linearity of a search, then such lengths would have to be addressed in determining whether a given algorithm is sub-linear and Petitioner's examples would have to account for those lengths. The Petition does not rely upon any variable other than the number of items in the database to be searched to determine whether a search is sub-linear. The Petition determines whether a search has a sub-linear running time exclusively with respect to the number of entries in the database to be searched.

Decision ('237) at 7.

78. Importantly, one skilled in the art would understand that under any possible interpretation of "sublinear" in the context of the '237 patent (as well as the general context of search algorithms), a search algorithm is sublinear only with respect to the size of the dataset (the size of the reference database), not the size of the query (pattern) of the work to be identified using the search. As Petitioner's expert confirmed, consistent with my understanding, whether a prior art search "scales based upon the size of the query or pattern" would not "be accurately assessing the '237 patent claims." Moulin Depo. 25:22-26:8.

11	Is it the case that for a search to be
12 3	ublinear as it's used in the '137 patent, it's not
13 e	mough for it to have execution time that is
14 5	sublinear in relationship to the size of the
15 F	mattern; it must also be sublinear in relationship
1 <i>6</i> t	to the size of the database?
17	A When I read "sublinear" in, say, Claim 5
18 0	of the patent, as we just did, I understand
19 :	sublinear to mean in relation with the size of the
20 3	iatabase. It does not say anything about in
21 1	elation with the size of the query.

Moulin Depo. 26:11-21.

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Will it be wring, then, th assess whether
a search is sufficient by applying a definition that
said, "It's sufficient if this execution time bas a
sufficient relationship to the site of the query of
the pattern"?
A - It would not be very relevant, Again,
mathematically, it can be done. Everything can be
done. But it would not be relevant, from an
engineering viewpoint, for an application like this.
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Moulin Depo. 25:4-12.

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Let's assume that the Fatent Trial and
1
    Appeal Board was presented with prior art that
    presented a search that was linear with respect to
         size of the database, but it was sublinear with
    respect to the size of the pattern.
5
              Would that prior art demonstrate a
    sublinear search as it's used in Claim 257
÷
          A Secole say it's a linear search, again,
    because it's in relation with the size of the
    database. And as you just said, that complexity is
    still linears so people would say it is a linear
          0
              It is not a sublinear search?
          A lt's only sublinear in terms of the size
    of the query, which is generally not the
   parameter of -- the relevant parameter.
15
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Moulin Depo. 26:25-27:15.

16	Q Is it the case that if we had a piece of
17	prior art that was linear with respect to the size
18	of the database but sublinear with respect to the
19	size of the query or the pattern, that that prior
2.0	art would not teach a sublinear search as it's used
21	in Claim 25?
22	A Again, if one Understands sublinear to be
23	in terms in relation to the size of the database,
24	that would be a a linear search.

Moulin Depo. 27:16-24.

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Let's assume we've got a piece of prior
á
    art that scales at a sublinear relationship with the
5
    size of the pattern or query but it scales at a
ř
    linear relationship with the size of the database
 77
    that's being searched.
55
              Would that prior art demonstrate or
9
   disclose a sublinear search as it's used in the
10
   claims of the '137 patent?
11
          A No. Again, because my understanding is
12
   the claims of the '237 patent, whenever there's
13
   mention of "sublinear," it means in terms of the
14
   database size. It does not say it explicitly; it's
15
     my inference based on my knowledge and my expertise.
16
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Moulin Depo. 28:4-16. I agree with the Petitioner's Declarant—that "sublinear" in the context of the IPR Patents is with respect to the size of the database, not the size of the query or pattern.

- B. non-exhaustive search ('237, '988, '179, and '441 patents).
 - The Board's preliminary construction of "non-exhaustive search" is consistent with the understanding of one of ordinary skill in the art: "a search that locates a match without a comparison of all possible matches."

79. A "non-exhaustive" search is a search that uses an algorithm designed to locate a match without comparing the work to all records in the database. A "non-exhaustive" search uses an intelligent algorithm to narrow the database to only a subset of potential matches. *See e.g.* Moulin Decl. (*988) ¶12 ("algorithms that increased efficiency by intelligently searching only a subset of potential matches (*i.e.*, 'non-exhaustive' algorithms)"); Pet. (*237) at 3 ("search algorithms that increased efficiency by intelligently searching only a subset of potential matches (*i.e.*, 'non-exhaustive' algorithms)").

80. For example, if there are 100 records in a database, a non-exhaustive search could use an intelligent algorithm to exclude 75 records from the search such that only 25 would be searched during the comparison process. As the specifications of the IPR Patents observe, these non-exhaustive "forms of matching include[ing] those based on clustering, kd-trees, vantage point trees and excluded middle vantage point forests" do not systematically compare the work to be identified to each record. *See e.g.*, '179, 9:14-17. Each of these examples uses an intelligent algorithm to narrow the database to only a subset of potential matches.

81. A "non-exhaustive" search can be contrasted with an "exhaustive" search. An exhaustive search systematically checks whether each potential match matches the work to be identified until a match is found, "perhaps halting the search when the first match is found." '237, 8:59-61. An exhaustive search is "a very general problem-solving technique that consists of systematically enumerating all possible candidates for the solution and checking whether each candidate satisfies the problem's statement." Ex. 2001 (the "solution" here refers to a record and not a section within that record).

82. If there are 100 records in the database, an "exhaustive" search does not narrow the potential matches but instead systematically compares the work with each record to determine a match (if there is one). Systematically comparing the work to be identified with each potential match until a match is identified rather than using intelligence to narrow the search candidates is also referred to as using "brute force." Moulin Decl. ('988) ¶44 ("a brute force search conducts a comparison of every item in a search database"); Ex. 2001.

Google Ex. 1020

2. The Board properly rejected Petitioner's assertion that a "non-exhaustive search" should be construed as "a search that locates a match without conducting a brute force comparison of all possible matches, <u>and all data within all</u> possible matches."

83. The "all data" clause (that I underlined above) in Petitioner's proposed construction (Pet. ('237) at 5; Decision ('237) at 5-7) would improperly include as a "non-exhaustive" search any search that did not compare "all data" in each record, even if the search were a brute force comparison of each record in the database. As an illustrative example, assume the work to be identified "ABC" is compared with all records in a library, including record "DEF." When comparing "ABC" with "DEF," the algorithm determines that there is no match between "ABC" and "DEF" after just comparing the first letter of the work "A" with the first letter of the record "D." If the algorithm does not unnecessarily compare the second and third letters, then according to Petitioner, the search is not "exhaustive" even though every record is compared.

84. Petitioner's Declarant states that a non-exhaustive search is any search that is not a brute force search, and a "brute force' search, in turn, is a search wherein a query is compared to every single portion of every single item in a database." Moulin Decl. (*237) ¶43. Petitioner's Declarant, however, provides no

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analysis or support for this conclusory assertion which, I understand, is insufficient to satisfy Petitioner's burden in these IPR proceedings.

85. One skilled in the art would understand that the "all data" clause is improper because it is:

- inconsistent with how the non-exhaustive search concept is used in the IPR Patents which describes a linear exhaustive search as one where the search compares the work to all "N entries," not all data within all "N entries" (*see e.g.*, '179, 21:10-42; 8:59-9:54); and
- not part of the ordinary meaning of "non-exhaustive search" (see Ex. 2001).
 - 86. Moreover, objective sources confirm my understanding that an

"exhaustive" or "brute-force" search systematically compares the work with each record in a database, not all data within each record, for example:

"In computer science, brute-force search or <u>exhaustive search</u>, also known as generate and test, is a very general problem-solving technique that consists of systematically enumerating all possible candidates for the solution and <u>checking whether each candidate</u> <u>satisfies the problem's statement</u>."

Ex. 2001-each "candidate" is checked, not "all data" within each candidate.

87. Petitioner's own Declarant twice confirmed my understanding-that a "non-exhaustive" search searches a subset of "potential matches," not a subset of "all data within all potential matches":

 (1) "Because neighbor searching is computationally intensive, content recognition schemes typically employed search algorithms that increased efficiency by intelligently searching only a subset of potential matches (*i.e.*, 'non-exhaustive' algorithms)." Moulin Decl. (*237) ¶12;

(2) "to maximize search efficiency, persons skilled in the art routinely employed more efficient searches that did not conduct a comparison of every single item in a database, sometimes referred to as non-exhaustive searches." Moulin Decl. (*237) ¶43.

88. For the reasons that I presented above, one skilled in the art would understand that the Board properly rejected Petitioner's "all data" clause.

Decision ('237) at 6.

C. neighbor search / identifying a neighbor / neighbor / near neighbor ('237, '988, '179, and '441 patents).

89. One skilled in the art would understand that the Board properly construed a "neighbor search" and "identifying a neighbor" as "identifying a close, but not necessarily exact or closest, match" and "neighbor" and "near neighbor" as

"a close, but not necessarily exact or closest, match." Decision ('237) at 8: Decision ('988) at 7-8; Decision ('179) at 8; Decision ('441) at 7.

90. Petitioner and its Declarant agree with the Board's construction of "neighbor search." *See e.g.*, Petition (*179) at 6 ("The term 'neighbor search' ... should be construed to mean 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""neighbor search' means 'identifying a close, but not necessarily exact, match.""); Moulin Decl. (*179) ¶45 (""necessarily e

91. One skilled in the art would understand that there are two relevant features of a neighbor search under this construction:

92. <u>Feature 1</u>: If a search necessarily identifies an exact or the closest match (*i.e.*, the search is designed to guarantee that an exact or the closest march is identified each time the search is performed), it is not a neighbor or near neighbor search because it is not a search that "identif[ies] a close, but not necessarily exact or closest, match." Rather, such a search necessarily identifies an exact or the closest match.

93. <u>Feature 2</u>: If a search that necessarily identifies an exact or the closest match (*e.g.*, Match 1) but also identifies other matches that, by definition, are not the closest match (Match 2, Match 3, Match 4), the search still necessarily identifies an exact or the closest match (Match 1) and therefore cannot be the claimed neighbor or near neighbor search.

D. approximate nearest neighbor search ('237 patent).

94. As I noted above, the Petitioner did not identify a construction of "approximate nearest neighbor search."

95. The Board preliminary determined that an "approximate nearest neighbor search" is a search "identifying a close match that is not necessarily the closest match." Decision ('237) at 9. One skilled in the art would understand that this construction is correct, but incomplete, as demonstrated by the '237 specification. The '237 specification states that the claimed "approximate nearest neighbor search" is [1] a sub-linear neighbor search that [2] does not always find the closest point to the query—*i.e.*, does not always find the closest match:

"[1] One example of a sub-linear time search is an approximate nearest neighbor search. [2] A nearest neighbor search always finds the closest point to the query. An approximate nearest neighbor search does not always find the closest point to the query. For example, it might do so with some probability, or it might provide any point within some small distance of the closest point."

237, 9:12-19.

96. The first feature—that a "approximate nearest neighbor search" is a sub-linear time search—is not reflected in the Board's preliminary construction and, as demonstrated below, should be included in the construction. The second

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feature of the claimed "approximate nearest neighbor search" is reflected in the Board's preliminary construction—"identifying a close match that is not necessarily the closest match." I address these two features in reversed order.

"identifying a close match that is not necessarily the closest match"

97. This feature of "approximate nearest neighbor search" was properly adopted by the Board. A search that is guaranteed to return the actual closet match is not an "approximate nearest neighbor search." The '237 specification states that an "approximate nearest neighbor search does not always find the closest point to the query." '237, 9:15–16. Accordingly, a search that "always finds" (*i.e.*, is guaranteed to find) the closest match is not an "approximate nearest neighbor search" while a search that is not guaranteed to find the closest match can be an "approximate nearest neighbor search" if it identifies a close match. *See* Pet. ('237) at 19 (stating that a reference discloses an "approximate nearest neighbor search" because the search "identifies a neighbor, but not necessarily the nearest neighbor.").

98. This understanding of "approximate nearest neighbor search" is consistent with the ordinary meaning of the phrase

"<u>Approximate nearest neighbor</u> In some applications it may be acceptable to retrieve a 'good guess' of the nearest neighbor. In those

cases, we can use an algorithm which doesn't guarantee to return the actual nearest neighbor in every case, in return for improved speed or memory savings."

Ex. 2008

(http://en.wikipedia.org/wiki/Nearest_neighbor_search#Approximate_nearest_neighbor.) at 5.

99. Similar to the neighbor and near neighbor searches addressed above, one skilled in the art would understand that a search that necessarily identifies both: (1) an exact match or the closest match, and, in addition, (2) "a close match that is not necessarily the closest match" is not an "approximate nearest neighbor search" because it is always guaranteed to identify the closest match.

2. "sublinear"

100. It is my understanding that an inventor may act as his or her own lexicographer in defining terms used in a patent's claims. One skilled in the art would understand that the '237 patent defines "approximate nearest neighbor search" as a type of sub-linear search.

101. <u>Title</u>: In the title of the '237 patent, the patentee identified an "approximate nearest neighbor search" as a type of sub-linear search: "Identifying works, using a sub-linear time search, such as an approximate nearest neighbor search, for initiating a work-based action, such as an action on the internet." '237, Title.

102. <u>Abstract</u>: It is my understanding that the abstract of a patent may be used to determine the scope of the invention. In its Abstract, the '237 patent also describes an "approximate nearest neighbor search" as a "sub-linear time search": "determining an identification of the media work . . . using a sub-linear time search, such as an approximate nearest neighbor search for example." '237, Abstract.

103. <u>Specification</u>: In describing methods for carrying out a sub-linear search of the reference data set, the '237 specification also describes an "approximate nearest neighbor search" as a type of sub-linear search: "One example of a sub-linear time search is an approximate nearest neighbor search." '237, 9:12–14.

104. In its preliminary construction, the Board did not include the sublinear feature of the claimed "approximate nearest neighbor search" based on what appears to be faulty logic. The Board preliminarily found:

We largely agree with Patent Owner's construction, but note that the Specification refers to "[o]ne example of a sub-linear time search is an approximate nearest neighbor search" (Ex. 1001, 9:12–14), such that we are not persuaded that an "approximate nearest neighbor search," must be a sub-linear search, as that term has been construed above. As such, we are persuaded that the proper construction of "approximate nearest neighbor search" is "identifying a close match that is not necessarily the closest match."

Decision ('237) at 9. The logic underlying the Board's reasoning appears to be as follows: If A is "one example" of B, A is not always B. In my opinion, this logic is faulty.

105. If A is "one example" of B, A is always B even though there may be examples other than A that fall within the scope of B. If A is "one example" of B, the scope of B is not limited to just A (*i.e.*, the scope of B can include C, D, and E) but A is always B. For example, a poodle is "one example" of a dog; a poodle is always a dog (there is no scenario where a poodle is not a dog) but there are other examples that fall within the scope of dog beyond poodles, *i.e.*, terriers, Dalmatians, etc. Just like a "poodle" being "one example" of a dog must be a dog (*e.g.*, a dog bred with a curly coat that is usually clipped ...) an "approximate nearest neighbor search" being "one example" of a "sublinear search that"

must be a sublinear search (*i.e.*, a "sublinear search identifying a close match that is not necessarily the closest match.")

VI. '237 patent.

106. I understand that the Board instituted the '237 IPR based on three Grounds:

- Ground 1: Claims 1, 3–5, 7–9, 11–13, 15, 16, 21–25, 29, 30, 33, 37, and 38 as unpatentable under 35 U.S.C. § 102(e) as anticipated by Iwamura;
- Ground 2: Claims 1–3, 5–7, 9–11, 13–15, and 21–24 as unpatentable under 35 U.S.C. § 102(b) as anticipated by Ghias; and
- Ground 3: Claims 26, 27, 34, and 35 as unpatentable under 35 U.S.C. § 103 as obvious over Iwamura and Chen.

Decision (*237) at 21-22. I address each Ground in turn.

A. <u>'237 Ground 1</u>: The instituted claims of the '237 patent are not anticipated by Iwamura.

107. The Board instituted Ground 1 based on the following: Claims 1, 3-5,

7-9, 11-13, 15, 16, 21-25, 29, 30, 33, 37, and 38 as unpatentable under 35 U.S.C.

§ 102(e) as anticipated by Iwamura. Decision (*237) at 21 (I underlined the

independent claims). Ground 1 fails because Iwamura does not disclose the following key elements from each instituted independent claim:

sub-linear time search (claims 1, 5);

approximate nearest neighbor (claims 9 and 13);

- nonexhaustive search ... to identify a near neighbor (claim 25); and
- sublinear approximate nearest neighbor search (claim 33).

l address each in turn.

1. sub-linear time search (claims elements 1(b) and 5(b.2)).

108. Claims elements 1(b) and 5(b.2) require a "sub-linear time search."

109. As I explained above, a "sub-linear time search" is "a search whose execution time scales with a less than linear relationship to the size of the data set to be searched." Decision (*237) at 7.

110. One skilled in the art would understand that Iwamura does not disclose a "sub-linear time search." Iwamura discloses a searching algorithm that

is designed to be more efficient than alternatives by comparing peak notes from the

work to be identified with the peak notes in the database. Iwamura, 6:59-60; 12:1-

2. While the individual comparisons of a work to a record in the library can be more efficient using this peak note approach, lwamura does not teach an algorithm that "scales with a less than linear relationship to the size of the data set to be searched" where the data set is either (a) the number of records in the database, or

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(b) even the length of an individual record. Instead, each melody in the melody database is processed as part of the disclosed comparison and "[t]he reference melody that gives the least difference is returned as a search result." Iwamura, 7:53-55.

111. Specifically, Iwamura confirms that the referenced Boyer-Moore algorithm (the basis for alleged disclosure of a sub-linear search in the Petition, Declaration, and Decision) searches all items in the database and even searches "word by word from the beginning of the database to the end" and therefore cannot scale with a less than linear relationship to the size of the data set being search *i.e.*, it is not sublinear:

"Boyer Moore (discussed below) or other string-matching algorithms do not have this kind of flexibility. They only search word by word from the beginning of the database to the end."

Iwamura, 9:52-55.15

112. The search algorithms disclosed in Iwamura do not reduce the number of records to be searched during a search (or even the data to be searched within a record) as the dataset increases. Rather, the disclosed algorithms speed up the comparison of the work to each record by matching peaks. Iwamura, 9:9-11. Accordingly, the disclosed algorithms in Iwamura search all records in the library,

¹⁵ The word-by-word comparison is valid for the worst case.

and the computational time that the disclosed search takes to make such comparisons grows linearly with the number of records in the database (the relevant analysis) and even linearly with the data in each record. Iwamura therefore teaches a linear search rather than the claimed "sublinear" search as the term is used in the IPR Patents, because the computational time that it takes to perform a search grows linearly as new data is added to the database.

113. The Petition fails to satisfy its burden of demonstrating that Iwamura teaches a "sub-linear time search." As support for the "sub-linear" elements, Petitioner (and corresponding Declaration) exclusively relies on the Boyer-Moore algorithm referenced in Iwamura:

114. <u>Petition</u>: The text of the Petition does not address the sub-linear elements or state that Iwamura discloses a "sub-linear time search." Pet. (*237) at 7-10. Neither the word sublinear nor the concept appears in the text of the Petition.

115. <u>Petition Chart</u>: In its chart, Petitioner exclusively relies on the referenced Boyer-Moore algorithm as support for the sub-linear search elements (highlighted in yellow in the passages below):

Claim 1(b):

b) determining, by the computer system, an identification of the media work media work using the received "find(ing) features extracted from the media work to perform a sub-linear time search of extracted features of the "Boys identified media works to identify a 10/1-31 v neighbor, and Ex 1004

Iwamura determines an identification of the media work using the extracted features by "find[ing] the closest melody from the database," which is a neighbor 9/25-38, 12/1-2. Iwamura discloses searching using the "Boyer-Moore algorithm" (9.63-64, 10/1-31, which is sublinear (Ex/1017 at 1) Ex/1004 at \$72.

Pet. (*237) at 10-11.

Claim 5(b.2) (Petitioner references Claim 1):

2) determining, by the computer system, an identification of the media work using the features extracted from the media work to perform a sub-linear time search of extracted features of identified media works to identify a neighbor, and	Petitioner incorporates the above discussion of Iwamura regarding Claim 1b.
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Pet. (*237) at 12.

116. Declaration: The Declaration also exclusively relies on the Boyer-

Moore algorithm as support for the sublinear search elements:

72. It is my opinion that Iwamira further teaches how this search can be sublinear. For example, Iwamira discloses that different "search algorithms may be applied to perform melody searches," (*id.* at 10.2-3), such as the "Boyer-Moore algorithm," (*id.* at 9.63), "On the average the [Boyer-Moore] algorithm has a sublinear behaviour," Fx. 1017 at 4.

Moulin Decl. (*237) ¶72.

117. Declaration Chart: The chart in the Declaration also exclusively relies

on the Boyer-Moore algorithm:

Claim 1(b):

b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform a sub-linear time search of extracted features of neighbor; and

Iwamura discloses the use of a "search engine" to determine an identification of the media work using the extracted features by "find[ing] the closest melody from the database," which is a neighbor. 9:25-38. 12:1-2 Iwamura discloses searching using identified media works to identify a the "Boyer-Moore algorithm" (9:63-64, 10.1-3), which is sublinear (Ex. 1017 at 1).

Moulin Decl. ('237) ¶75.

Claim 5(b.2) (the Declarant references Claim 1):

 determining, by the computer system, an identification of the media work using the features extracted from the media work to 	I incorporate my above discussion of Iwamura regarding Claim 1b.
perform a sub-linear time search of extracted features of identified media works to identify a neighbor, and	

Moulin Decl. (*237) ¶75.

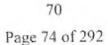
118. Neither the Petition nor Declaration identifies any basis for asserting

that Iwamura discloses the sub-linear search elements other than the referenced

Boyer-Moore algorithm. Pet. ('237) at 10-12; Moulin Decl. ('237) ¶72. My

understanding is confirmed by Petitioner's Declarant:

23	Q The only thing you identify in your
24	Declaration about Iwamura that could disclose a
25	sublinear time search is the Boyer-Moore algorithm;
1	correct?
2	A As far as I remember, yes. In that
3	Declaration at that time, yes.



Moulin Depo. 82:23-83:3.

119. One skilled in the art would understand that the referenced Boyer-Moore algorithm, however, does not disclose or even address a sublinear search that is "a search whose execution time scales with a less than linear relationship to the size of the data set to be searched." Decision ('237) at 7. Because Iwamura itself does not state that Boyer-Moore algorithm is sublinear, the entire basis in the Petition and corresponding Declaration for the claimed sublinear elements is the single statement in the Petitioner's Declaration:

"On the average the [Boyer-Moore] algorithm has a sub-liner behavior." Moulin Decl. (*237) ¶72 (quoting Ex. 1017 at 1). One skilled in the art would understand that this statement is not accurate with respect to the relevant sub-linear behavior, *i.e.*, with respect to the size of the database. My understanding was confirmed by Petitioner's Declarant who testified that:

- he understood that "sub-linear" in the context of the '237 patent is based on the size of the data set searched, not the size of the query or pattern to be matched (from the work to be identified):
- (2) the Boyer-Moore algorithm does not disclose a search that is sublinear with respect to the dataset or database or even the length of a record to be search (it does not even address a database or dataset); and

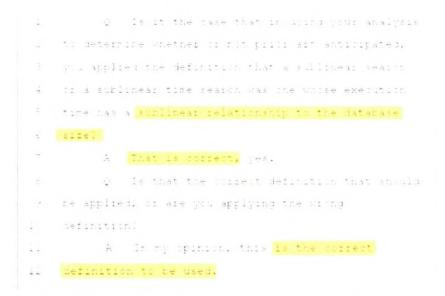
(3) that when he wrote "which is sublinear" in his Declaration, he did not intend the Board to interpret "sublinear" in the context of the '237 patent but instead in a different context unrelated to '237 patent.

120. (1) As I noted above, Petitioner's Declarant understood that

"sublinear" in the context of the '237 patent is based on the size of the searched dataset, not the size of the query or pattern of the work to be matched (which is the correct understanding):

53. I understand and agree with Petitioner's position that the term "sublinear search" means "a search whose execution time has a sublinear relationship to database size." For instance, a linear search of a 200-item database would take twice as long as a linear search of a 100-item database. By contrast, a sublinear search of a 200-item database would take less than twice as long as a sublinear search of a 100-item database, perhaps, for instance, 1.5 times as long.

Moulin Decl. (*237) ¶53.



Moulin Depo. 24:1-12.

1 E	is it the case that for a search to be
1.2	sublinear as it's used in the '13" patent, it's not
13	enough for it to have execution time that is
14	sublinear in relationship to the size of the
15	pattern; it must also be sublinear in relationship
⊥€	to the size of the database?
17	A When I read "sublinear" in, say, Claim 5
16	of the patent, as we just did, I understand
19	sublinear to mean in relation with the size of the
20	database. It does not say anything about in
	relation with the size of the query.

Moulin Depo. 26:11-21.

4	Q Would it be wrong, then, to assess whether
5	a search is sublinear by applying a definition that
6	said, "It's sublinear if this execution time has a
7	sublinear relationship to the size of the query or
8	the pattern"?
ç	A It would not be very relevant. Again,
0	mathematically, it can be done. Everything can be
1	done. But it would not be relevant, from an
12	engineering viewpoint, for an application like this.

Moulin Depo. 25:4-12.

25	Let's assume that the Patent Trial and
1	Appeal Board was presented with prior art that
-	presented a search that was linear with respect to
з	the size of the database, but it was sublinear with
4	respect to the size of the pattern.
103	Would that prior art demonstrate a
é	sublinear search as it's used in Claim 25?
7	A People say it's a linear search, again.
(1)	hecause it's in relation with the size of the
524	database. And as you just said, that complexity is
10	still linear; so people would say it is a linear
11	search.
12	Q It is not a sublinear search?
13	A It's only sublinear in terms of the size
14	of the query, which is generally not the
15	parameter of the relevant parameter.

Moulin Depo. 26:25-27:15.

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21	1: 141	n 153					
	44. 1-1-1	Ag	ain,	11 C	ne und	ierstands	sublinear to be
23	in terms	s in	relat	ion	to the	e size of	the database,
÷4	that wor	ild b	e a ·	- ă	linea:	r search.	

Moulin Depo. 27:16-24,

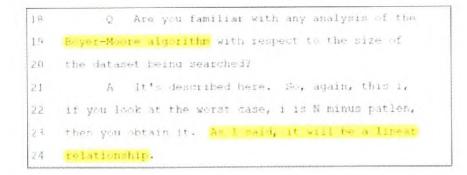
4 let's assume we've got a piece of prior ast that scales at a sublinear relationship with the size of the pattern or query but it scales at a linear relationship with the size of the database that's being searched. Would that prior art demonstrate or disclose a sublinear search as it's used in the claims of the '237 patent? 11 A No. Again, because my understanding is the claims of the '137 patent, whenever there's 14 cention of "sublinear," it means in terms of the 19 database size. It does not say it explicitly; it's 16 my inference based on my knowledge and my expertise.

Moulin Depo. 28:4-16.

14	Q When you wrote your Declaration, you had
15	in mind that sublinear meant having execution time
16	that increased at a less-than-linear relationship
17	compared to the size of the dataset being searched;
18	right7
19	A That's in the context of database search,
20	yes.
21	Q And then you wrote this claim chart in
1. N. 44 44	order to indicate where in Iwamura it disclosed each
23	part of the claim; right?
24	A That's correct, yes.

Moulin Depo. 77:14-24.

121. (2) Petitioner's Declarant confirmed my understanding—that the Boyer-Moore algorithm referenced in Iwamura does not disclose a search that is sublinear with respect to the database size (*i.e.*, the size of the data set to be searched)—it does not even address a database (Moulin Depo. 53:19-22 ("There's no database in Boyer-Moore."))—but instead has a relationship to the size of the guery pattern from the work to be identified:



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Moulin Depo. 61:18-24; 44:20-46:6; 59:6-9; 61:25-62:9; 68:25-69:4.

122. (3) Petitioner's Declarant confirmed my understanding—that the statement in his Declaration—Petitioner's only support for the sub-linear elements—was wrong. He testified that when he wrote:

"On the average the [Boyer-Moore] algorithm has a

sublinear behaviour." Ex. 1017 at 1.

(Moulin Decl. ('237) ¶72) and wrote just a few pages earlier:

53 I understand and agree with Petitioner's position that the term "sublinear search" means "a search whose execution time has a sublinear relationship to database size." For instance, a linear search of a 200-item database

(Moulin Decl. ('237) ¶53), he was not trying to convey that the Boyer-Moore algorithm was sublinear or "has a sublinear behavior" in the context of the '237 patent -i.e., "has a sublinear relationship to the database size":

20 Q When you wrote this, were you trying to 21 convey that searching using the Boyer-Moore 20 algorithm would be sublinear with respect to the 23 size of the dataset being searched? 24 A No. I did not -- no.

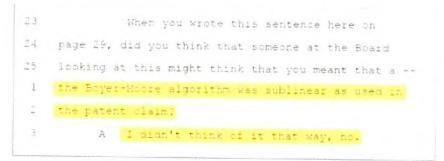
Moulin Depo. 74:20-24; 74:8-12.

9	Q When we read paragraph 72, are you
10	conveying to the reader that the Boyer-Moore
11	algorithm is sublinear with respect to the size of
12	the dataset being searched?
13	A No. All I do is quote a part of a paper
14	that shows why that algorithm is much faster than
15	brute force. That's all I'm doing. You're
16	inferring things I'm not saying or writing.

Moulin Depo. 69:9-16.

9	In paragraph 72, are you representing to
10	the Board that it's your understanding that the
11	Boyer-Moore algorithm has a sublinear behavior with
12	respect to the size of the dataset?
13	A No. This is just a quote of another paper
14	discussing Boyer-Moore. This Boyer-Moore algorithm
15	has been used in a variety of contexts, including,
31	of course, content recognition. I'm simply quoting
17	from another paper here. I'm not presenting
18	anything about what you asked.

Moulin Depo. 66:9-18.



Moulin Depo. 75:23-76:3.

) = 	 And when you write this, were you trylt 	17
1÷	to invey to the Board that the Boyer-Monte	
. 9	algorithm is one that, if you use it, it's wublin	ear
	with respect to the size of the database?	
21	A No. No.	

Moulin Depo. 67:17-21.

123. Consistent with my understanding, Petitioner's Declarant clarified that he was not claiming that the Boyer-Moore algorithm referenced in Iwamura discloses a sub-linear search in the context of the '237 patent, *i.e.*, with respect to the size of the dataset:

2.5	And next to the phrase "a sublinear time
i.	seaion" in the claim, you wrote, "The Boyer-Mosse
÷	algorithm, which is sublinear"; right?
3	A ls's not me who wrote it. I'm quoting
4	from a reference.
5	Q Meli, you wrote the words "which is
é	sublinear"; tight]
	A - I guotes from a reference, Again, showing
9	ony there are much faster alternatives to trute
÷.	forte.
11	Q Let me rephrase it
11	A life not again, to make it very clear,
1.4	its not claiming that using Boyer-Moore simply alone
13	is doing to yield a sublinear search for that
14	natabase problem. I'm not claining that. Just to
15	ie to make it clear.

Moulin Depo. 77:25-78:15.

16	Q Okay. Nould you agree, sir, that if
17	that one way to read this would be that you were
1.9	claiming that the claim language, "perform a
19	sublinear time search," was satisfied by searching
20	using the Boyer-Moore algorithm?
21	A That might be one way of reading it. It's
22	not the way I'm reading this now.
23	As I said, the way I'm reading this is I'm
24	quoting language from a reference. And, again, to
2.5	make the record clear, I'm not claiming that
1	Boyer-Moore, as this alone, is going to give us a
2	sublinear time search in a database search problem.
3	I'm not claiming that. And I did not claim it in
4	this document.

Moulin Depo. 78:16-79:6.

ţ.	Q Would it be reasonable for the Board to
10	have read this as you opining, you asserting, that
L L	Iwamura discloses a sublinear time search because it
12	discloses searching using the Boyer-Moore algorithm.
13	which is sublinear?
14	A Again, I don't know how different people
15	can read it. If there's any ambiguity, I hope I
16	just cleared it up. I'm not claiming that
17	Boyer-Moore alone is going to give us a sublinear
18	time search for the database search problem.

Moulin Depo. 79:9-18

```
A Cletter, there are many words that I -- I'm
     sure i contra cave inches petter words. . . . adree
     with you, there is pullarly setted as in this
     this. I are't suspute that.
         . Do you agree that it would have neen
     Batter to tall the Risto. Mithe Degenetions algorithm
    is linear, not soblinear"?
       A - 1 don't -- I'm not saying it's linear
    either. I is I dot't know. All I's saying is I's
      of representing that the Boyer-Moore algorithm
             going to give us a sublinear time search.
   for database searching. That's all I'm saying.
          Q Mould the Boyer-Moore algorithm alone give
    you a sublinear time search for searching a string?
11
          A Again, are you looking at worst case? The
   answer is no.
```

Moulin Depo. 79:19-80:12; 80:15-83:3.

124. Accordingly, one skilled in the art would understand that the support in the Petition and Declaration for the sublinear search elements fails to disclose the sublinear search elements.

125. <u>Board's concerns</u>: I now address the Board's specific concerns (identified in its Decision) with respect to whether Iwamura discloses the claimed "sub-linear time search." In instituting Ground 1, I note that the Board preliminary found that Iwamura disclosed the "sub-linear time search because (a) a sub-linear

search of the data within the records can be sublinear even if every record in the database is searched, and (b) Patent Owner's argument that Boyer-Moore searches all items in the database therefore does not demonstrate that the Boyer-Moore algorithm is not sub-linear:

In addition, we note that no claim in the '237 Patent requires the searching, in the determining aspect of the claims, to be both nonexhaustive and sub-linear, such that a sub-linear search of the data within the records, even if every record is searched, can potentially teach the aspect of independent claims 1 and 5 which recite "perform[ing] a sub-linear time search of extracted features." Although the Specification of the '237 Patent discloses that a sub-linear search is performed on the records of the database and not information within the records, the claims do not specify that the sub-linear search must be performed on a subset of all of the records, and not information within individual records.

Decision ('237) at 11.

Patent Owner also argues that Iwamura's use of the "Boyer-Moore algorithm' searches all items in the database and therefore is not sublinear." Prelim Resp 18–19 As discussed above, we are not persuaded that this is a deficiency with respect to the instant claims.

Decision ('237) at 12. It is my opinion that the Board's preliminary analysis is flawed on multiple levels for the reasons I explain below.

126. First, the Board's preliminary analysis is based on an incorrect

interpretation of the construction of sub-linear as it would be understood by one skilled in the relevant art at the time of the inventions. The Board construed a

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"sublinear" search as "a search whose execution time scales with a less than linear relationship to the size of the data set to be searched." not the length of any specific record in the database. As I explained above in detail above and reflected in in the Board's analysis of the construction of sub-linear, the data set is the number of records in the database to be searched—"the size of the data set ("N")." Decision ('237) at 7.

127. In addition, as I explained above in detail, those skilled in the art understand that the size of the data set in the context of the '237 patent refers to the number of records in the database to be searched (N) and not the length of any particular record in the database. This understanding is consistent with Dr. Moulin's explanation in his Declaration. *See* Moulin Decl. ('237) ¶53. Accordingly, the Board's preliminary analysis is based on an improper interpretation of the construction of "sublinear."

128. Second, it is my understanding that the Board's preliminary analysis has the relevant burden backwards—it is not the Patent Owner's burden to demonstrate that the referenced Boyer-Moore algorithm does not disclose a sublinear search. Rather it is my understanding that it was the Petitioner's burden to demonstrate that referenced Boyer-Moore algorithm discloses a sublinear search. As I showed above, Petitioner failed to satisfy this burden. As I explained

above, in my opinion, one of ordinary skill in the art would understand that Boyer-Moore algorithm is not a sublinear search in the context of the '237 patent.

129. Third, one skilled in the art would understand that there is no evidence under any interpretation of sublinear in the context of the '237 patent that the referenced Boyer-Moore algorithm discloses a search that is sublinear with respect to either (a) the "size of the dataset" (Decision ('237) at 7); or (b) the length of an individual record being searched. In my opinion, one of ordinary skill in the art would understand that it is not.

130. The two references to the Boyer-Moore algorithm in Iwamura are:

Moore (discussed below) or other string-matching algorithms do not have this kind of flexibility. They only search word by word from the beginning of the database to the end.

Iwamura, 9:52-55.

There are many studies for fast and efficient string search techniques. For example, the Boyer-Moore algorithm is wellknown as one of the best solutions. See

Iwamura, 9:61-64. While the Boyer-Moore algorithm is described as being "efficient," one skilled in the art would understand that neither passage states that the algorithm is sublinear with respect to either the number of references in the database or the length of an individual record to be searched.

131. Fourth, as I explained above, Petitioner's Declarant confirmed my understanding—that the referenced Boyer-Moore algorithm does not disclose a search that is sublinear in the context of the '237 patent.

approximate nearest neighbor search (claim elements 9(b) and 13(b.2)).

132. As I presented above, one of ordinary skill in the art would understand that, in the context of the '237 patent, an "approximate nearest neighbor search" is a sub-linear search identifying a close match that is not necessarily the closest match. Also, as I explained above, a search that necessarily identifies the closest match is not an "approximate nearest neighbor search" even if it also identifies other near matches.

133. One skilled in the art would understand that Iwamura does not disclose the claimed "approximate nearest neighbor search" for two independent reasons.

134. <u>Reason 1</u>: One skilled in the art would understand that Iwamura does not disclose an "approximate nearest neighbor search" because Iwamura does not disclose "identifying a close match that is not necessarily the closest match." Iwamura discloses a search that always identifies an exact or the closest match. Consistent with my understanding, Petitioner's Declarant likewise confirmed that

Iwamura will either produce an "exact match" if it finds one, or the "best match it finds using that approximate criterion." Moulin Depo. 271:22-272:12.

135. The system in Iwamura will always find the closest match, even if unimportant peaks are skipped or repeated patterns are avoided. My understanding is consistent with the understanding of Petitioner's Declarant:

- "[W]'re still going to be identifying the closest match" even when "the unimportant peaks are skipped.... Dropping an unimportant part is not going to affect the ability to find the best match." Moulin Depo. 317:14-23.
- "If we implement that feature of Iwamura... skipping a repeated pattern....
 It will not affect the ability to find the best match." Moulin Depo. 318:11-18.

136. Petitioner asserts that Iwamura identifies a neighbor because: "the 'search engine will find the closest melody from the database." Pet. ('237) at 8 (*quoting* Iwamura, 9:24-25)); Moulin Decl. ('237) ¶69. A person of ordinary skill in the art would understand that these statements do not disclose an "approximate nearest neighbor search" which is a search identifying a close match that is not necessarily the closest match. Instead, these statements confirm that Iwamura always identifies the closest match—necessarily the closest match—rather than a match that is not necessarily the closest match as required by the claimed

"appropriate nearest neighbor search." See '237, 9:15–16 (an "approximate nearest neighbor search does not always find the closest point to the query.").

137. Because the searches disclosed in Iwamura necessarily return the closest match, they are not search algorithms that identify a match that is not necessarily the closest match, as the properly construed claim element requires. Accordingly, in my opinion, Iwamura neither expressly nor inherently (necessarily) discloses an "approximate nearest neighbor search"—a search that does not necessarily find the closest match.

138. <u>Reason 2</u>: One skilled in the art would understand that Iwamura does not disclose an "approximate nearest neighbor search" because Iwamura does not disclose a sublinear search. As I demonstrated above, an "approximate nearest neighbor search" is "one example" of a sublinear search. Also, as I demonstrated above, Iwamura does not disclose a sublinear search. Accordingly, Iwamura does not disclose the claimed "approximate nearest neighbor search."

139. One skilled in the art would understand that the Petition, Declaration, and corresponding charts fail to demonstrate that Iwamura discloses the claimed "approximate nearest neighbor search." As support for the claimed "approximate nearest neighbor search," the Petition and corresponding Declaration rely on (1) the fault tolerance feature, and (2) skipped portions feature, described in Iwamura.

140. Petition: The text of the Petition does not address the claimed

"approximate nearest neighbor search"-I note that the words "approximate

nearest neighbor search" do not appear in the text of the Petition.

141. Petition Chart: Petitioner provides the following in its claim chart:

Claim 9(b):

b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works, and Petitioner incorporates the above discussion of Iwamura regarding Claim 1b. Furthermore, Iwamura uses an approximate nearest neighbor "search engine [that] hasimput fault tolerance capability" (10.17-18), and skips "portions that should not be searched" (12:6-7), such as "repeated patterns" (9:36-44), and "unimportant portion[s]" of the melody (9:44-45).

Pet. (*237) 12.

Claim 13(b.2) (referencing claim element 9(b)):

2) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works,	Petitioner incorporates the above discussion of Iwamura regarding Claim 9b.
and	

Pet. (*237) 13.

142. Declaration: The text of the Declaration also does not address the

claimed "approximate nearest neighbor search."

143. Declaration Chart: Petitioner' Declarant provides the following in its

claim chart:

Claim 9(b):

b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works, and 1 incorporate my above discussion of Iwamura regarding Claim 1b. Furthermore, Iwamura discloses using an approximate nearest neighbor "search engine [that] has imput fault tolerance capability" (10-17-18), and skips "portions that should not be searched" (12:6-7), such as "repeated patterns" (9:36-44), and "unimportant portion[s]" of the melody (9:44-45)

Moulin Decl. (*237) ¶75.

Claim 13(b.2) (referencing claim element 9(b)):

2) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works, and

1 incorporate my above discussion of Iwamura regarding Claim 9b

Moulin Decl. (*237) ¶75.

144. I note that these statements in the Petition (and Declaration) and

corresponding passages from Iwamura do not:

(a) provide a construction of "approximate nearest neighbor search,"

- (b) explain how Iwamura discloses the claimed "approximate nearest neighbor search."
- (c) explain why the fault tolerance capability and skipped portion are relevant to

or disclose an "approximate nearest neighbor search," and

(d) establish that Iwamura discloses an "approximate nearest neighbor search."

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145. One skilled in the art would understand that the quoted passages do not disclose an "approximate nearest neighbor search" because the quoted passages do not disclose a search that (a) is not guaranteed to identify the closest match, and (b) is sublinear.

146. First, as I noted above, the passage from element 1(b) crossreferenced in Petitioner's chart ("Petitioner incorporates the above discussion of Iwamura regarding Claim 1b") does not disclose an "approximate nearest neighbor search." As I explained above, one skilled in the art would understand that an "approximate nearest neighbor search" identifies a close match that is not necessarily the closest match. *See* Decision (*237) at 9. The passage cited in the Petition (and corresponding Declaration) confirms that the search disclosed in Iwamura finds "the closest melody from the database." Pet. (*237) at 8 (*quoting* Iwamura, 9:24-35).

147. Second, one skilled in the art would understand that Petitioner's references to searches that have (a) an "input fault tolerance" (Pet. ('237) at 12, *quoting* Iwamura, 10:17-18), or (b) skipped "portions that should not be searched" (Pet. ('237) at 12 *quoting* Iwamura, 12:6-7, 9:36-44, and 9:44-45) do not expressly or inherently (necessarily) disclose a search that does not necessarily identify the closest match and is sublinear. A key issue in addressing whether a search is an "approximate nearest neighbor search" is whether the search is designed to and

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will necessarily identify an exact match or the closest match, or whether the search could identify search results that do not include an exact or the closest match. If a sublinear search can return a "close match that is not necessarily the closest match," it is an "approximate nearest neighbor search." But if a search cannot return a "close match that is not necessarily the closest match" (because it is designed to only find the closest match), then it is not an "approximate nearest neighbor search," irrespective of how the search is performed.

148. The input fault tolerance and skipped sections search features describe how a peak note search may be performed. Neither enables a peak note search to return a result other than the closest match. While the Petition identifies these two search features—the way the search is conducted—the Petition does not address the output of the searches much less identify a search that does not necessarily identify the closest match. As demonstrated above, the output from any disclosed lwamura search always identifies the closest match and therefore is not an "approximate nearest neighbor search"—a search "identifying a close match that is not necessarily the closest match." Iwamura therefore does not disclose an approximate nearest neighbor search. I will specifically address each of the two search features identified by Petitioner is addressed in turn.

input fault tolerance

149. Iwamura discloses that its peak note search can include an "input fault tolerance." Iwamura, 9:20-24. Input fault tolerance allows a user to identify the closest match, even when the melody entered by a user has some errors. Iwamura, 9:33-39 (input fault tolerance enables "a correct search . . . notwithstanding inaccurate input from the user."). Using the fault tolerance feature, the peak note search first performs a search based on a tolerance of no errors, then a tolerance of one error, then a tolerance two errors, *etc*. The search will continue to search based on additional errors only if the search has not identified a match.

150. Accordingly, using the fault tolerance feature, the Iwamura search always produces an exact match or the closest match—it does not produce a result that is not necessarily the closest match. *See e.g.*, Iwamura, 11:43-45 ("The invented input fault tolerance function allows the user to obtain an exact result even when an entered melody has some errors."). Because the record identified using the fault tolerance search is necessarily the closest match, it is not a search that returns a "close match that is not necessarily the closest match," and, as a result, the feature does not disclose the claimed "approximate nearest neighbor search."

skipped sections

151. Iwamura also teaches that the disclosed search has "flexibility on search area" within a record in the reference database. Iwamura, 9:35. For

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example, a user can identify the "important" portions of a melody, thereby enabling the search to skip the remaining "unimportant" portions. *See* Iwamura, 9:45-50 ("In a long music selection, there are some important portions that are indispensable to identify the melody. These portions are well recognized and remembered by the user. The user identifies such important portions as a keyword (key-melody). The other unimportant portions [in a long reference melody] can often be ignored."). The skipped sections feature is a pre-processing component, and what remains to be searched can be viewed as the "extracted" features over which an exhaustive search is performed until a match is found.

152. Iwamura does not disclose that flexibility on search area enables the Iwamura search to return a result other than the closest match. *See* Iwamura, 9:35-55. Because the record identified using the skipped portion search feature is still necessarily the closest match, it is not a search that returns a "close match that is not necessarily the closest match" and the feature does not disclose the claimed "approximate nearest neighbor search."

153. Moreover, as I explained above, an "approximate nearest neighbor search" is a sub-linear search, and each of the passages cited by Petitioner does not disclose a sub-linear search.

Board's concerns:

154. I now address the Board's specific concerns (identified in its Decision) with respect to whether Iwamura discloses the claimed "approximate nearest neighbor search." In instituting Ground I, the Board preliminary found that Iwamura disclosed the "approximate nearest neighbor search" because the "approximate nearest neighbor search" "does not require that all of the records in the library are not used":

With respect to "approximate nearest neighbor search." Patent Owner argues that the input fault tolerance capability of Iwamura cannot teach the same because it does not state or imply "that all records in the music library are not used in the comparison as required in an 'approximate nearest neighbor search.'" *Id.* at 19–20. Our construction of "approximate nearest neighbor search" to be "identifying a close match that is not necessarily the closest match" does not require that all of the records in the library are not used, so we also do not find this to be a deficiency of the ground.

Decision ('237) at 12. It is my opinion that the Board's preliminary analysis is flawed at multiple levels.

155. First, it is my understanding that the Board's preliminary analysis has the relevant burden backwards—it is not the Patent Owner's burden to demonstrate that the referenced "fault tolerance capability of Iwamura" does not disclose an "approximate nearest neighbor search." Rather it was the Petitioner's burden to demonstrate that Iwamura (and the "fault tolerance capability") discloses an

"approximate nearest neighbor search." As I demonstrated above, Petitioner did not satisfy this burden.

156. Second, as I demonstrated above, one skilled in the art would understand that there is no evidence that the referenced "fault tolerance capacity of Iwamura" teaches a search that identifies a close match that is not necessarily (*i.e.*, not guaranteed to be) the closest match rather than search that is guaranteed to identify the closest match. As I demonstrated above, the evidence confirms the opposite—that Iwamura finds "the closest melody from the database." Pet. (*237) at 8 (*quoting* Iwamura, 9:24-25).

157. Third, as I demonstrated above, an "approximate nearest neighbor search" is a sublinear search, and there is no evidence that the referenced "fault tolerance capability of Iwamura" teaches a sublinear search as the phrase is used in the context of the '237 Patent.

3. nonexhaustive search (claim element 25(b)).

158. As I explained above, a "nonexhaustive search" is "a search that
locates a match without a comparison of all possible matches." Decision ('237) at
7.

159. One skilled in the art would understand that Iwamura does not disclose a non-exhaustive search as the phrase is used in the context of the '237

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Patent. As I described above, Iwamura discloses a searching algorithm that is designed to be more efficient than alternatives by lining up peak notes from the music work to be identified with the peak notes in each record in the music database when comparing the work to each record. Iwamura, 12:1-2. Instead of comparing the work to be identified with a record in the database by (a) preforming a first comparison of the notes in the work and the record, and then (b) shifting the comparison between the work and the record "note by note" to see if there is a match, Iwamura teaches that the shifting can be done peak-note-to-peaknote, thereby reducing the number of comparisons made between the work and a specific record, thus making the comparison more efficient.

"Peak notes are approximately 20% of the total number of notes in a typical melody. That means search speed using peak notes is 20% of a brute force search which shifts the entered melody, note by note."

Iwamura, 9:9-11; *see* Iwamura, 5:9-13 ("The peaks in all the melodies stored in the databases are marked in advance. For melody matching, the entered melody is time-shifted . . . so that its peak matches each peak in the reference melody.").

160. This peak note search process can be illustrated using the example notes from Iwamura (Iwamura, 7:11-45). The following illustrates a first comparison between the notes from the work to be identified and the notes in a single record in the database:

					Co	mp	ari	son	1				
Work to be identified			0	0 -1								ſ -2	ľ .2
	٦	5	0	55	10	۴	٢	1	p	P			
Record in the database	4	3	*5	0	-1	-2	-2	*5	-10	2			
Computation (absolute ofference)			0	1	2	6	5	0	10	3	Te	otal	27

The top row represents the notes in the work to be identified; the middle row (highlighted in green) represents the notes of the record in the database being searched; and the bottom row (text in red) represents the absolute difference between the compared notes. The "peak notes" in the work to be identified and the record being searched are identified by "*". In this first comparison, the first peak note from the work to be identified (*5) and the record (*5) are aligned (as illustrated by the dashed red outline). Note that the computation (the absolute difference between the work to be identified and the record) results in a total value of 27 (0+1+2+6+5+0+10+3).

161. In a second comparison between the work to be identified and this same record in the reference database, the record in the database is shifted to the right by a single note (this is the "note by note" approach referenced in Iwamura (Iwamura, 9:9-11)):

			- A-						e by				
Work to be identified		0	0	5.	-	1	0 -	10	0	0	1	1	
AADER ID DE KOEUTINED	NAMES AND ADDRESS OF T	3	-1	1	*6	5	2		. A.	. T	- 6-	-	
	٦	3	0	55	Ja	٢	٢	0	P	P	-		1
Record in the database	4	3	*5	0	-1	-2	-2	*5	-10	2	5	hifted 1	note
Computation (appointe ofference)		2	6	1	5	5	7	5	9	3	To	tal: 43	har

The peak notes are not aligned in this comparison (as illustrated by the dashed red outline). The computation (the absolute difference between the work to be identified and the record) results in a total value of 43 (2+6+1+5+5+7+5+9+3).

162. An alternative to the second comparison presented above is to use the peak note approach taught in Iwamura. Using this peak note approach, the second comparison between the notes of the work to be identified and the notes in the record in the database is not just shifted one note to the right but is shifted to the right to align the next peek note (*i.e.*, five notes to the right), thereby skipping what would have been four intermediate comparisons using the alternative note by note approach:

C	ompar	150	18 4 1	201	ant t	O II	GVI	hes	BP5 81	ore	8		
Work to be identified	-5	0 -1	1	4	1	1.0	17.	-1	0 -1	- ~ ~	1-2		
Record in the database			4- <u>0-0-0</u> -014-01	1 4	3	0 15	П. 0	0 -1	ſ -2	ſ -2	0 *5	-10 2	shifted to next peak rote
Computation (absours difference)			an y connel	0	0	0	0	0	1	0	7	Total: 8	L

As a result, the peak note approach taught in Iwamura avoided four unnecessary comparisons between the work to be identified and this reference work, making this peak note search more efficient. Note that the computation now results in a total absolute difference of 8. The number of comparisons that are avoided is 4 * (length of the query) as computing the individual distances between the notes requires a comparison.

163. Each melody in the melody database is compared using this peak note approach and "[t]he reference melody that gives the least difference is returned as a search result." Iwamura, 7:53-55. Because the peak note search algorithm disclosed in Iwamura does not reduce the number of records to be searched or even the notes in each record to be searched but rather speeds up the individual comparison of the work to be identified to each record (by shifting the comparisons by peak notes rather than note by note), the disclosed algorithm searches all records in the library and is therefore an exhaustive search rather than the claimed "non-exhaustive" search. This approach does not reduce the number of records being searched *e.g.*, by discarding clusters of potential matches, like the sub-linear searches addressed in the IPR Patents. *See e.g.*, '237, 8:64-9:7 ("Other forms of matching include those based on <u>clustering, kd-trees, vantage point trees and</u> **excluded middle vantage point forests** are possible and will be discussed in more detail later.... Thus, for example, a <u>sub-linear search time can be achieved.</u>")

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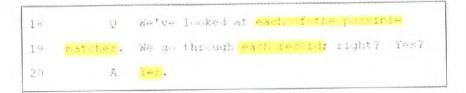
While the individual comparisons of a work and a record in the library can be more efficient using the peak note approach disclosed in Iwamura ("search speed can be increased"), in doing so each record in the library is searched as part of the disclosed algorithm and "[t]he reference melody that gives the least difference is returned as a search result." Iwamura, 7:53-55.

164. Accordingly, one skilled in the art would understand that Iwamura teaches an exhaustive search rather than the claimed "non-exhaustive" search, because it searches all records in the database using the peak note approach.

165. I note that Petitioner's Declarant, Dr. Moulin, confirmed that "for all the Iwamura searches...[i]t's understood that you search through every musical work in the database"—*i.e.*, all potential matches (Moulin Depo. 269:19-270:2):

(*). NG	Q You would agree that in Iwamura, the
3	search that's identified there does make a
4	comparison to each of the possible musical works
5	that could be returned as a match?
ć	MR. ELACQUA: Objection.
- I	THE WITNESS: To each of the musical works,
(D)	yes.

Moulin Depo. 223:2-8.



Moulin Depo. 247:18-20.



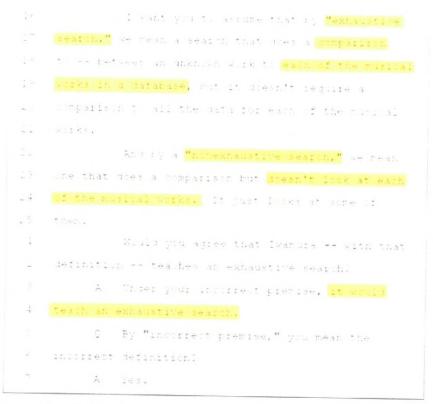
Moulin Depo. 271:19-21.

	libertified and described in Iwardra, what is thes to
10	it does a comparison of the unknown melody to <mark>each</mark>
1	of the melody patterns that are in the nelody
	database; iight:
2.3	A Yes.

Moulin Depo. 207:18-23. As a result, consistent with my understanding and the understanding of one skilled in the art, Petitioner's Declarant confirmed that, based on the proper construction of a non-exhaustive search (adopted by the Board), lwamura does not disclose a non-exhaustive search:

24	Q By "nonexhaustive search," we mean a
25	search that does a comparison but doesn't look at
1	each of the melodies in our reference database.
12	It's going to skip over some of them.
3	By "exhaustive search," we're going to go
a fr	to each one of them. We might not use all the data
5	for that melody, but we're going to do some
6	comparison of the data to each of the melodies.
7	Do you understand?
8	A Yes.
9	Q With that definition, does Iwamura
10	disclose a an exhaustive search or a
<u>1</u>	nonexhaustive search?
12	A Well, with your, again, incorrect
13	definition, that would be an exhaustive search.
14	But, again, I disagree with your definition.

Moulin Depo. 233:24-234:14.



Moulin Depo. 225:16-226:7.

> Q Before that search is run, each of those 1 works is a possible match; right? A Yes. (WI O Would you agree that the Iwamura search, 1 when it's run, it does a comparison of the unknown $\overline{a_1}$ work to each of those possible matches? 6 A To each of those possible music works, yes. An approximate comparison, just to be clear. R Q And by "approximate," you mean that it 0 doesn't necessarily look at every bit of data in 10 every musical work? A It does not necessarily -- exactly -- use 12 all the data, and then it uses only approximations 14 to the matching criterion. Q But it does examine each of the possible 15 musical works -- or each of the musical works that 15 could be returned as a possible match? 17 A Yes. 18

Moulin Depo. 217:1-18.

166. I note that Petitioner's Declarant also confirmed that (as illustrated in the examples presented above) "all the notes" from each record in the database are compared. As a result, the searches disclosed in Iwamura would not be non-exhaustive even based on Petitioner's construction that includes the improper "and all data within all possible matches" clause (Pet. (*237) at 6):

```
    I understand. But if we've got in if
    Database a += it's a fectual one peak. We've got a
    set in tes += it dress't say emiliate gust one
    peak, dres it!
    A 001.
    We're evaluating all the notes in that
    poraser right?
    A Bight, Bight, Bight.
```

Moulin Depo. 280:6-13.

```
it says, "In this manner, the entered
relody is shifted to each peak in each reference
relody and compared."
is you see that:
A. Yes.
Q. Ices this constate to you that Iwamura is
teaching a peak search method in which it's going to
compare the unknown melody with each peak in the --
each reference melody?
A. In this case -- I'm just reading the
context. Okay?
So all the notes are used. Thay. We are
notes are used in this example. So all the
notes are used in this example, and therefore, ne
context the -- you be a, the least aresput error
```

Moulin Depo. 277:6-21.

167. The Petition, Declaration, and corresponding charts fail to

demonstrate that Iwamura discloses a "nonexhaustive search." Petitioner and its

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Declarant identify three features of the Iwamura search as teaching non-exhaustive searching:

- (a) <u>peak notes</u>: a search that shifts the comparison of the notes in the work to be identified with the notes in a records by peak notes rather than noteby-note;
- (b) <u>limit function</u>: comparing the work to be identified with a specific record in the database can be stopped and shifted to the next peak notes when the computation of the total absolute difference between the notes in the work to be identified and the specific record exceeds a certain limit;
- (c) <u>unsearched portions</u>: a search that skips portions that should not be searched, such as "repeated patterns" and "unimportant melodies."

Pet. ('237) at 9-10. Petitioner identifies these three features from Iwamura (labeled

• ,• , and • below) as disclosing the non-exhaustive search in its Petition, Declaration, and corresponding charts, addressing either all three features or two of the features:

168. Petition:

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Cham 25 of the '237 patent further requires that the search is

Pet. ('237) 9-10.

169. Petition chart:

b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a nonexhaustive search of reference extracted features of reference media works to identify a near neighbor, and	Petitioner incorporates the above discussion of Iwanura regarding Chim 9b. Iwanura further discloses non-exhaustive search algorithms using "peak notes" (6:31- 7:55), which "are approximately 20% of the total number of notes in a typical melody," meaning "search speed using peak notes is 20% of a brute force search" (9:9-10). The search is further non- exhaustive because it can be accelerated by stopping the search when computations "exceed] a certain limit." 7:56-57
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Pet. (*237) 15.

170. Declaration:

> 73. It is my opinion that Iwamura's disclosure that the search can be accelerated by stopping the search when computations "exceed[] a certain limit" is another example of non-exhaustive searching. Ex. 1012 at 7:56-57.

74. It is my opinion that Iwamura's disclosure of skipping "portions that should not be searched" (Ex. 1012 at 12:6-7) wherein these skipped portions include "repeated patterns" (*id.* at 9:36-44) and "unimportant portion[s]" of the melody (*id.* at 9:44-5) constitutes another example of non-exhaustive searching.

Moulin (*237) Decl. ¶71, 73-74.16

171. Declaration Chart:

I incorporate my above discussion of Iwamura regarding Claim 9b. Iwamura b) determining by the computer further discloses using non-exhaustive system, an identification of the search algorithms using "peak notes" (6:3) media work using the media work 7.55), which "are approximately 20% of 🖤 extracted features to perform a the total number of notes in a typical nonexhaustive search of reference melody," meaning "search speed using extracted features of reference peak notes is 20% of a brute force search" media works to identify a near (9:9-10). The search is further nonneighbor; and exhaustive because it can be accelerated by stopping the search when computations 🥝 "exceed[] a certain limit." 7:56-57

¹⁶ Paragraph 72 of Dr. Moulin's Declaration addresses the "sublinear" rather than the "non-exhaustive" element.

Moulin Decl. (*237) ¶75.

172. One skilled it the art would understand that none of these three Iwamura search features disclose the claimed "non-exhaustive search." Each feature accelerates search speed within a single comparison of a work to be identified with a record in the reference database. No feature, however, enables the disclosed search to locate a match without comparing the work to be identified with each record in the reference database. I address each feature in turn.¹⁷

173. <u>peak notes</u>: A person of ordinary skill in the art would understand that the Iwamura "peak note" approach does not disclose a search that can locate a match without a comparison of all possible matches. As I explained above, a feature of the Iwamura search is that the search speed can be increased if the peaks of a melody input by a user are matched to the peaks of each reference melody, *i.e.*, each record in the reference database and the comparison between the work

¹⁷ I observed that Petitioner's Declarant also confirmed that another search feature disclosed in Iwamura—fault tolerance (that was not identified by Petitioner as support for the "non-exhaustive" search element)—also "does a comparison of the unknown work to each of the melodies in our reference database ...it compares with every musical work, yes, in the database" and is therefore an exhaustive rather than non-exhaustive search. Moulin Depo. 268:15-20.

and the record is shifted by peak notes rather than note by note. See Iwamura 5:9-13 ("The peaks in all the melodies stored in the databases are marked in advance. For melody matching, the entered melody is time-shifted . . . so that its peak matches each peak in the reference melody.").

174. Peak note searching accelerates a search within a single comparison of the work to be identified with an individual record because, when comparing the notes of the work with the notes of the record, it shifts the notes to be compared by peak notes rather than note by note:

"Peak notes are approximately 20% of the total number of notes in a typical melody. That means search speed using peak notes is 20% of a brute force search which shifts the entered melody, note by note."

Iwamura, 9:8-11.

175. While this search technique may be efficient, the peak note searching disclosed in Iwamura still requires exhaustively searching every reference melody. Iwamura, 9:11-13 (discussing a faster comparison of "each reference melody" with respect to peak note searching); *see also* Iwamura, 7:52-54 (noting that in the search process, "the entered melody is shifted to each reference melody and compared"). As Petitioner's Declarant repeatedly confirmed (consistent with my understanding) "you search through every musical work in the database" for "all

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the Iwamura searches" (including the "peak note" approach) (Moulin Depo.

269:19-270:2):

. Would grow sizes that in Deamura's pass
if the melody database
A ves, it does. It's gring to compare it
ith every song in the database, typically.

Moulin Depo. 213:23-214:2; 223:2-8; 247:18-20; 271:19-21.

176. Under the proper construction of "non-exhaustive," the "peak note" approach and the corresponding passages from Iwamura cited in the Petition and Declaration do not disclose a non-exhaustive search because they do not state or suggest that all references in the music library are not compared. Rather, all reference melodies are compared and "[t]he reference melody that gives the least difference is returned as a search result." Iwamura, 7:52-55. Accordingly, a search using "peak notes" is not a non-exhaustive search.

177. Moreover, even applying the "all data" clause in Petitioner's improper construction—a non-exhaustive "search ... locates a match without conducting a brute force comparison of ... all data within all possible matches"—the peak note search disclosed in Iwamura is still an exhaustive (rather than non-exhaustive) search because it compares "all data within all possible matches." When comparing a work to be identified with each potential match, the peaks of the song

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to be identified are lined up with the peaks of the reference work to expedite the comparison: "In this manner, the entered melody is shifted to each peak in each reference melody and compared." Iwamura, 7:52-55. But in doing so, this does not mean that only the peaks from the work to be identified are compared to the peaks of the reference work. Rather, once the peaks are lined up, both the peaks and valleys (all data) are compared in the computation. Dr. Moulin, at his deposition, agreed with this understanding of the peak note search:

E. Q It says, "In this manner, the entered 7 melody is shifted to each peak in each reference melody and compared." 8 Do you see that? 9 A Yes. O Does this indicate to you that Iwamura is 11 12 teaching a peak search method in which it's going to 13 compare the unknown melody with each peak in the --14 each reference melody? A in this case -- I'm just reading the 15 16 context; Okay? So all the notes are used. Okay. We are 17 16 back to this same numerical example. So all the notes are used in this example, and therefore, he 19 evaluates the -- you know, the least absolute error 21 criterion.

Moulin Depo. 277:6-21.

178. While the Petition (Pet. ('237) at 5) quotes a passage from Iwamura that suggests Iwamura avoids a "brute force" search, one skilled in the art would

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understand that the "brute force" being avoided (and what makes the algorithm efficient) is that peaks are not compared to valleys and valleys are not compared with peaks. Instead, by lining up the peaks when comparing the data, peaks are compared with peaks and valleys are compared with valleys. Therefore, when Iwamura states that its approach is 20% more efficient than a brute force search, one skilled in the art would understand that this does not mean that the peak note approach disclosed in Iwamura does not consider "all possible matches" or even "all data in all possible matches." Rather, it means that by lining up the peaks when doing the comparison, it will save time over comparing the music to be identified with the referenced song without first lining up the peaks; shifting the comparisons by peak notes is more efficient than simply shifting the comparisons "note by note." Iwamura, 9:8-11.

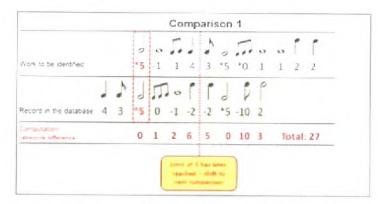
179. <u>limit function</u>: One skilled in the art would understand that the limit function approach addressed in Iwamura does not disclose non-exhaustive search under either the proper construction or under the Petitioner's flawed construction. Under the proper construction, a non-exhaustive search locates a match without comparing the work to be identified with all possible records in the reference database. The Iwamura limit function is not a search that locates a match without comparing the work to be identified with all possible matches. The Iwamura limit function accelerates the process of comparing the work to be identified to a single

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record in the reference database. The limit function describes the ability of a user to input a "limit" whereby a computation based on comparing the notes of the work to be identified with the notes of an individual record for a particular peak will be stopped and shifted to the next peak for that record when the total absolute difference between the compared notes exceeds a certain value. Iwamura, 7:56-58.¹⁸ Nothing in Iwamura talks about absolute distance calculated for a record (*i.e.*, across all peaks in the record), only for each peak.

180. For example (using the examples provide in Iwamura, 7:11-45), assume a user inputs a limit where the computation comparing the notes of the work to be identified and a single record in the database would be stopped when the total absolute difference in the computation exceeds 5:

¹⁸ Computation refers to the process of comparing the absolute difference between the integer values assigned to the notes in the work to be identified (the melody input by the user to be identified) and a single melody record in the reference database for a specific peak comparison.



This comparison would be stopped before all notes have been compared for this specific alignment because comparing the first four notes results in a computation of an absolute difference that exceeds the limit of 5: 0 + 1 + 2 + 6 exceeds the set limit of 5.

181. Once a peak range search is stopped by the limit function (*i.e.*, the total absolute difference exceeds a certain limit so that the computation is stopped), the search shifts to the next peak range comparison within the same record, and continues the search process until each peak in each record is compared against the melody input by the user. A search that uses the limit function disclosed in Iwamura will still compare every record in the reference database: "In this manner, the entered melody is shifted to each peak in each reference melody and compared. The reference melody that gives the least different is returned as a search result." Iwamura, 6:31-7:55. My understanding of how the limit function of Iwamura works was confirmed by Petitioner's Declarant:

23	Q Now, if we and then, as you understand
24	it, what the search algorithm would do, it would
25	then shift this peak over to the next peak and start
1	another calculation; is that right?
1.2	A Yes. Yes.

Moulin Depo. 241:24-242:2.

182. Petitioner's Declarant confirmed that "you search through every musical work in the database" for "all the Iwamura searches" (including the limit function approach). Moulin Depo. 269:19-270:2.

17	Q when we throw in this limit on the
19	computation, we are going to still do a comparison
15	to each of the works that are in our database;
20	right?
21	A We do a comparison of some data within
22	each musical work, yes.
23	Q You don't read this as saying that if
24	we're doing a computation, and for one of them it
25	exceeds a certain limit, then we stop the search
I	altogether? It doesn't say that, does it?
1.1	A No. We move to the next one.
(15)	Q By "the next one," you mean the next
4	computation?
5	A The next possible match. Like after the
Ę	first line in your example, we move to the second
7	one.

Moulin Depo. 243:17-244:7.

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1	C If we use this parameter in doing out
	real in learning is in the lase that after we
21	definition that the calculation control for ${\rm P}^{+}$ Field
	then that we stop the search altogether. If it we
- 3	keep altulation
.54	A No. We move to the next one. On live
-5	were, if the garameter value is 1., buce we teach
1	$\mathbb C$, we abanding this and move on to the next spec
	2. Then after we complete the peak search
÷	analysis for a given work, then we go to the next
4	work: is that right?
5	A Yes.

Moulin Depo. 242:19-243:5.

183. One skilled in the art would understand that the limit function search disclosed in Iwamura is therefore exhaustive.

184. Moreover, even using the "all data" clause from Petitioner's improper construction, one skilled in the art would understand that the limit function algorithm disclosed in Iwamura is still exhaustive rather than non-exhaustive because it compares "all data within all possible matches." While the search comparing a particular peak pattern of a work against a record can be stopped if the difference exceeds a certain limit, this does not mean that the comparison of the work with the record stops. Rather, as I described above, this means that the data in the work will be shifted against the record to match up with the next peak and the comparison of all the data will continue. Nothing in Iwamura expressly states

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that all data will not be searched and a search that does not compare all data is also not inherent (*i.e.*, necessarily present).

185. <u>unsearched portions</u>: One skilled in the art would understand that this unsearched portion approach disclosed in Iwamura does not disclose a nonexhaustive search. If a search compares the work to be identified to each reference in a database, it is not the claimed non-exhaustive search. Even if certain portions of a reference are skipped, the unsearched portions approach of Iwamura still compares the work to be identified with all potential matches. Consistent with my understanding, Petitioner's Declarant confirmed that all musical records in the reference database are searched under all Iwamura searches (including the unsearched portions approach):

> 19 Q Is it true that for all the Iwamura 20 searches, all the variations that Iwamura teaches, 21 it always teaches doing a comparison to each of the 22 musical works that's a possible match in our 23 database? 24 A I don't think it says it explicitly every 25 time. It's -- it's often implicit. It's understood 1 that you search through every musical work in the 2 database.

Moulin Depo. 269:19-270:2.

186. Petitioner's Declarant specifically confirmed, consistent with my understanding, that all potential matches in the database are searched using Imamura's unsearched portions approach:

All right. So let's assume we've got our
iatarase up. We've identified the unimportant
sections, and we're not going to assess those when
we're doing out Iwanuia search.
Does that make sense?
A Yes.
In that case, failing to test a relody
against an Unimportant part will not result in us
ignoring a match. Would you agree?
A That is correct, assuming it's truly an
unimportant part, yes.

Moulin Depo. 317:2-12.

Q Now, one of the features of Iwamura is an alternative in which the database can be set up where you're going to not -- you're going to ship portions of the reference melodies. You're only going to use what he identifies as the important parts; right?
A lest
In that -- when that version of Iwamura is used, is it the case that the Iwamura search will do a corparison to each of the musical works that are in the database?

Moulin Depo. 267:13-24.

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187. Iwamura does not expressly state (nor is it inherent, *i.e.*, necessarily present) that flexibility on search area enables the disclosed search to entirely skip a record in the reference database. Each and every record in the reference database will be searched; therefore, the search is an exhaustive search rather than the claimed non-exhaustive search. Moreover, when a repeated pattern (*e.g.*, "second measure") is skipped, it is a "reasonable engineering assumption" that the search has "already tested" the repeated pattern and, as a result, all data is considered in the search. Moulin Depo. 279:7-14. Moreover, Iwamura states that each repeated portion can be pre-processed and is marked as such in the database. Iwamura, 9:39-42. Accordingly, the unsearched portion process constitutes extracting the features of the melodies to be compared and the resulting search searches all pre-processed data.

188. <u>Board's concerns</u>: I now address the Board's specific concerns (identified in its Decision) with respect to whether Iwamura discloses the claimed nonexhaustive search. In instituting Ground 1 of the '237 Petition, the Board determined that one feature of Iwamura identified by Petitioner the "computational limits" feature—discloses a non-exhaustive search because if the computation limit (comparing the notes in the work to be identified with a single record in the database) is reached, the entire search is stopped, independent of how many records in the database have actually been searched:

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Patent Owner also argues that Iwamura's computational limit does not create a nonexhaustive search because "it does not state or suggest that all records in the music library are not use[d] in the comparison." Prelim. Resp 18. We do not agree. If, in Iwamura, the computational limit is reached, the search is stopped, even if not all of the records have been searched. Per our construction of "nonexhaustive search," i.e., "a search that locates a match without a comparison of all possible matches," we are persuaded on this record that the process of Iwamura, with the computational limit, would prevent all of the records of the remote music database from being searched, but would ultimately provide a match because of the input fault tolerance process, discussed above. *See* Ex. 1012, 7:56–57, 9:20–34.

Decision (*237) at 11-12. In making this preliminary finding, it appears that the Board apparently confused:

(a) stopping an individual computation of the absolute difference between the notes in the work to be identified with a specific record in the database for a specific alignment of peak notes and then shifting the peaks to perform another peak comparison with that record, with

(b) stopping the entire search process altogether.

In my opinion, there are at least two reasons why the Board's preliminary interpretation of Iwamura is not correct.

189. <u>Reason 1</u>: Iwamura does not state (or even suggest or imply) that when a given computation (the absolute difference between the compared notes) based on comparing a work to be identified with a specific record in the database

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exceeds a certain limit (demonstrating that the particular alignment of work to be identified with the specific record being searched is not a match) the entire search stops. Neither the Petition, Petitioner's Declarant, nor the Board points to such a statement in Iwamura, because one skilled in the art would understand that there is none. Rather Iwamura states that to accelerate comparing the peaks of the work to be identified with a single record in the database, the "computation of the total absolute difference" between the melody and a specific reference work based on that search can be stopped and shifted to the next comparison:

To accelerate the search, computation of the total absolute difference can be stopped when it exceeds a certain limit.

Iwamura, 7:56-57.

190. The individual computation based on that particular alignment between the peak notes of the work to be identified and the record "can be stopped" when that individual computation exceeds a certain limit. The search process itself is not stopped but rather accelerated: "[t]o accelerate the search." "In this manner, the entered melody is shifted to each peak in each reference melody and compared. The reference melody that gives the least difference is returned as a search result. Iwamura, 6:31-7:55. The specific computation is stopped, not the search: "it would then shift this peak over to the next peak and start another calculation." Moulin Depo. 240:24-242:2.

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191. Again, I note that, consistent with my understanding. Petitioner's Declarant confirmed that under the computation limits approach disclosed in Iwamura (as well as all other approaches in Iwamura), all potential matches are searched:

1.9 Q is it true that for all the Iwamura searches, all the Variations that Examuna teaches, it always teaches doing a comparison to each of the musical wirks that's a possible match in our 13 database? A I don't think it says it explicitly every 18 time. It's -- it's often implicit. It's understood 1 that you search through every musical work in the database.

Moulin Depo. 269:19-270:2.

Q when we throw in this limit on the
computation, we are going to still do a comparison
to each of the works that are in our database;
right?
A We do a comparison of some data within
each musical work, yes.
Q You don't read this as saying that if
we're doing a computation, and for one of them it
exceeds a certain limit, then we stop the search
altogether? It doesn't say that, does it?
A No. We move to the next one.
Q By "the next one," you mean the next
computation?
A The next possible match. Like after the
first line in your example, we move to the second
ose.

Moulin Depo. 243:17-244:7.

```
19
        Q If we use this parameter in doing our
20 search in Iwamura, is it the case that after we
21 determine that one calculation should be stopped,
   then that we stop the search altogether, or do we
22
   keep calculating --
23
         A No. We move to the next one. So like
24
25
   here, if the parameter value is 20, once we reach
    20, we abandon this and move on to the next one.
1
          Q Then after we complete the peak search
2
    analysis for a given work, then we go to the next
 3
   work; is that right?
4
         A Yes.
 5
```

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Moulin Depo. 242:19-243:5.

192. <u>Reason 2</u>: One skilled in the art would understand that the alternative (which is not disclosed in Iwamura)—that the entire search process stops when one peak search comparison between the work to be identified and one record in the database reaches a certain limit—would make the search process inoperable. The purpose of Iwamura is to find a match. Stopping the search when an individual computation exceeds a certain limit would prevent the search from finding a match. For example, assume that:

- there are 10 records in the dataset to be search;
- the computation based on the first peek note alignment between the work to be identified and the first record in the database exceeds the set limit.

Stopping the search at that point—after comparing the work to be identified with just the first alignment of the first record—would identify no match even if records 4, 7, and 8 were close matches and record 9 was an exact match. The system would be inoperable and would fail to identify matches if the search is stopped completely when a computational limit is reached rather than, as disclosed in Iwamura, the search moves on to (a) the next alignment of peak notes between the work to be identified and that same record in the database, or (b) the next potential record in the database to identify a match. Stopping the search when a given computation exceeds a certain limit will speed up comparing the work to be

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identified with a given record in the database but it does not stop the search process.

193. I note that the Board also noted that if Iwamura disclosed a search that is not a nonexhaustive search, this "does not end the inquiry"—Iwamura could still teach a nonexhaustive search as long as, in addition to disclosing other searches, Iwamura actually disclosed the claimed nonexhaustive search:

We note that all of the independent claims of the '237 Patent utilize "comprising" language, such that those claimed methods and apparatuses do not exclude additional, unrecited elements or method steps. *See Mars Inc. v. H.J. Heinz Co.*, 377 F.3d 1369, 1376 (Fed. Cir. 2004). Thus, the scope of independent claim 25 can include an exhaustive search, as long as it performs a nonexhaustive search as well. Thus, even if Patent Owner is correct and a particular search in Iwamura is exhaustive, that does not end the inquiry.

Decision ('237) at 11. As I demonstrated above, one of ordinary skill in the art would understand that Iwamura does not disclose any nonexhaustive searches.

identify a neighbor / near neighbor (claims elements 1(b), 5(b), and 25(b)).

194. In instituting Ground 1, the Board did not specifically address whether Iwamura disclosed the neighbor or near neighbor properties of the claimed search. Decision (*237) at 11-12. As I demonstrated below, one skilled in the art would understand that Iwamura does not disclose such properties.

195. As I explained above, identifying "a neighbor" or "near neighbor" means identifying "a close, but not necessarily exact or closest, match." Decision (*237) at 8.

196. Iwamura does not disclose a search to identify a neighbor or near neighbor because, as I explained above, the disclosed search always identifies an exact or the closest match. Iwamura confirms that the disclosed search engine will find the "closest" match—the melody that gives the least difference. Iwamura, 9:54-55. Petitioner's Declarant also confirmed that Iwamura will either produce an "exact match" if it finds one, or the "best match it finds using that approximate criterion." Moulin Depo. 271:22-272:12.

197. One skilled in the art would understand that the system in Iwamura will always find the closest match, even if unimportant peaks are skipped or repeated patterns are avoided. At his deposition, Dr. Moulin agreed to my understanding:

 "[W]'re still going to be identifying the closest match" even when "the unimportant peaks are skipped.... Dropping an unimportant part is not going to affect the ability to find the best match." Moulin Depo. 317:14-22.

"If we implement that feature of Iwamura... skipping a repeated pattern...
 It will not affect the ability to find the best match." Moulin Depo. 318:11-

18.

Because the search algorithms disclosed in Iwamura necessarily return the closest match, they do not identify a match that is not necessarily the closest match, as the neighbor and near neighbor claim elements require. Iwamura does not disclose identifying a neighbor or near neighbor because the disclosed search always identifies an exact or the closest match.

198. The Petition, Declaration, and corresponding charts fail to demonstrate that Iwamura discloses the claimed neighbor or near neighbor searches.

199. The Petition does not address the "neighbor" concepts in the text of the Petition. In its Charts, to establish the claimed search "to identify a neighbor" (elements 1(b) and 5(B.2)) and search "to identify a near neighbor" (element 25(b)), Petitioner asserts:

Claim 1(b):

b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform a sub-linear time search of extracted features of identified media works to identify a neighbor, and Iwamura determines an identification of the media work using the extracted features by "find[ing] the closest melody from the database," which is a neighbor 9:25-38, 12:1-2. Iwamura discloses searching using the "Boyer-Moore algorithm" (9:63-64, 10:1-3), which is sublinear (Ex. 1017 at 1). Ex. 1004 at ¶ 72.

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Pet. ('237) at 10-11.

Claim 5(b.2):

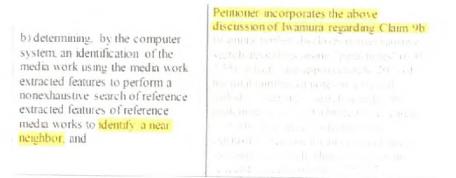
2) determining, by the computer system, an identification of the media work using the features extracted from the media work to perform a sub-linear time search of extracted features of identified media works to identify a neighbor, and	Petitioner incorporates the above discussion of Iwamura regarding Chim 1b
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Pet. (*237) at 12.

Claim 25(b): Petitioner incorporates its discussions regarding element 9(b)

(the remaining discussion addresses the non-exhaustive component of the claim

element):



Pet. (*237) at 15.19

For claim element 9(b), Petitioner asserts:

¹⁹ The referenced claim element 9(b) does not include a search "to identify a

near neighbor" but instead includes "an approximate nearest neighbor search."

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b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works, and	Petitioner incorporates the above discussion of Iwamura regarding Chim 1b. Furthermore, Iwamura uses an approximate nearest neighbor "search engine [that] has input fault tolerance capability" (10:17- 18), and skips "portions that should not be searched" (12:6-7), such as "repeated patterns" (9:36-44), and "unimportant portion[s]" of the melody (9:44-45).
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Pet. ("237) at 12.

200. The Declaration is essentially the same.

Claim element 1(b):

b) determining, by the computer system, an identification of the media work using the received	Iwamura discloses the use of a "search engine" to determine an identification of the media work using the extracted features
features extracted from the media work to perform a sub-linear time	by "find[ing] the closest melody from the database," which is a neighbor, 9:25-38,
search of extracted features of identified media works to identify a	12-1-2. Iwamura discloses searching using the "Boyer-Moore algorithm" (9:63-64.
neighbor, and	10.1-3), which is sublinear (Ex. 1017 at 1).

Moulin Decl. ('277) ¶75.

Claim element 25(b) cross references claim element 9(b):

b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a nonexhaustive search of reference extracted features of reference media works to identify a near neighbor, and	I incorporate my above discussion of Iwamura regarding Claim 9b. Iwamura further discloses using non-exhaustive search algorithms using "peak notes" (6:31- 7:55), which "are approximately 20% of the total number of notes in a typical melody," meaning "search speed using peak notes is 20% of a brute force search" (9:9-10). The search is further non- exhaustive because it can be accelerated by stopping the search when computations "exceed[] a certain limit." 7:56-57.
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Claim element 9(b):

b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works, and Encorporate my above discussion of Jwamura regarding Claim 1b. Furthermore, Iwamura discloses using an approximate nearest neighbor "search engine [that] has input fault tolerance capability" (10.17-18), and skips "portions that should not be searched" (12:6-7), such as "repeated patterns" (9:36-44), and "unimportant portion[s]" of the melody (9:44-45)

201. One skilled in the art would understand that these discussions and the cited passages from Iwamura do not demonstrate that Iwamura teaches a search that identifies a neighbor or near neighbor for the reasons that I set forth above.

202. First, the cited passage from element 1(b) does not disclose a search that identifies a neighbor or near neighbor. As I explained above, a search that identifies a neighbor or near neighbor is a search that identifies "a close, but not necessarily exact or closest, match." Decision (*237) at 8. The passage cited in the Petition and corresponding declaration confirms that the Iwamura searches find "the closest melody from the database." Pet. (*237) at 8 *(quoting* Iwamura, 9:24-35).

203. Second, the references to searches that have an "input fault tolerance" or skip "portions that should not be searched" (Pet. (*237) 13 quoting Iwamura 10:13-18, 12:6-7, 9:36-44, and 9:44-45) do not expressly or inherently disclose a search that does not necessarily identify the closest match. As I demonstrated above, the output from any disclosed Iwamura search always identifies the closest match and therefore is not a search that identifies a neighbor or near neighbor—"a

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close, but not necessarily exact or closest, match." *See e.g.*, Iwamura, 11:43-45 ("The invented input fault tolerance function allows the user to obtain an exact result even when an entered melody has some errors.").

sublinear approximate nearest neighbor search (claim element 33(b)).

204. Claim 33 requires a search that is both (a) a sublinear, and (b) an approximate nearest neighbor search.

205. One skilled in the art would understand that Iwamura does not disclose a "sublinear approximate nearest neighbor search" for at least two independent reasons.

206. <u>Reason 1</u>: As I demonstrated above (with respect to claim elements 1(b) and 5(b.2)), Iwamura does not disclose a "sublinear" search.

207. <u>Reason 2</u>: Also as I demonstrated above (with respect to claim elements 9(b) and 13(b.2)), Iwamura does not disclose an "approximate nearest neighbor search."

208. The Petition, Declaration, and corresponding charts fail to demonstrate that Iwamura discloses the claimed "sublinear approximate nearest neighbor search." For claim 33, the Petition and corresponding Declaration do not address the "sublinear approximate nearest neighbor search" in their respective

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texts but instead exclusively cross-reference their respective charts for Claims 1(b)

and 9(b).

Petition:

b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a sublinear approximate nearest neighbor search of reference extracted features of reference identified media works, and	Petitioner incorporates the above discussion of Iwamura regarding Claims Ib and 9b.
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Pet. (*237) at 16.

Declaration:

 b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a 	I incorporate my above discussion of Iwamura regarding Claims 1b and 9b
sublinear approximate nearest neighbor search of reference	
extracted features of reference identified media works; and	

Moulin Decl. (*237) ¶75. As I demonstrated above, the cross-referenced

"discussions" and citations to Iwamura fail to demonstrate that Iwamura discloses

either a "sublinear" search or an "approximate nearest neighbor search."

Accordingly, the Petition fails to satisfy its burden for these two independent

reasons.

209. Board's concerns: I addressed the Board's concerns with respect to

the "sublinear" component above in Section VI(A)(1). I addressed the Board's

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concerns with respect to the "approximate nearest neighbor component" above in Section VI(A)(2).

B. '237 Ground 2: The instituted claims of the '237 patent are not anticipated by Ghias.

210. The Board instituted Ground 2 based on the following: Claims 1-3,

<u>5</u>-7, 9-11, <u>13</u>-15, and 21-24 as unpatentable under 35 U.S.C. § 102(b) as anticipated by Ghias. Decision ('237) at 21 (I underlined the independent claims). Ground 2 fails because Ghias does not disclose the following key elements from each instituted independent claim:

- sub-linear time search (claim elements 1(b) and 5(b.2)); and
- approximate nearest neighbor search (claim elements 9(b) and 13(b.2)).

I address each in turn below.

sublinear time search (claim elements 1(b) and 5(b.2)).

211. Claims elements 1(b) and 5(b.2) require a "sub-linear time search."

212. As I explained above, one of ordinary skill in the art would understand that a "sub-linear time search" is "a search whose execution time scales with a less than linear relationship to the size of the data set to be searched." Decision ('237) at 7.

213. Ghias does not disclose a "sub-linear time search" search but instead teaches a linear search in which the search time grows linearly in relationship to the size of the data set. The searches disclosed in Ghias compare the work (user input 23) with "all the songs" in the library (*i.e.*, what the Petition calls "all possible matches," Pet. 6):

In order to search the database, songs in the database 14 are preprocessed to convert the melody into a stream of the previously discussed U,D,S characters, and the converted user input (the key 23) is compared with all the songs.

Ghias, 5:66-6:2.²⁰ If an increase in a given variable increases the execution time of a given algorithm by an amount that is only a constant multiple of the amount by which that variable was increased, irrespective of the initial value of that variable, then that algorithm scales linearly with regard to that variable.²¹ More specifically,

²⁰ To compare the "user input" with "all the songs," Ghias must compare the user input with every song in the data set. Ghias does not disclose a search algorithm that does not compare the work to be identified with every record in the data set.

As I explained above, linearity describes "[t]he relationship existing between two quantities when a change in a second quantity is directly proportionate to a change in the first quantity." Ex. 2007 (Modern Dictionary of Electronics) at 425 (1999).

if f(n1, ..., ni, ..., nk) is a function that describes the execution time of an algorithm where variables n1, ..., ni, ..., nk are the sizes of the different types of data on which the algorithm operates, then if f(n1, ..., ni+q, ..., nk) = f(n1, ..., ni,..., nk) + f(n1, ..., q, ..., nk), then that algorithm scales linearly with regards to variable ni. Because a constant increase in the size of the data set (*i.e.*, number of records in the reference data set) increases the execution time of the Ghias search algorithm by a constant amount that does not depend on the initial size of the data set, Ghias discloses a linear time search, not a sub-linear time search.

214. In addressing "the problem of approximate string matching," Ghias identifies "the running times of several algorithms:

> Several Algorithms have been developed that address the problem of approximate string matching. Running times 25 have ranged from 0(mn) for the brute force algorithm to 0(kn) or 0(nlog(m), where "0" means "on the order of," m is the number of pitch differences in the query, and n is the size of the string (song).

Ghias, 6:23-28. In each instance, the running time of the identified search is linear (not sub-linear) with respect to the size of the data set.

215. As clarified in this passage from Ghias:

 "m is the number of pitch differences in the query" corresponding to the length of the query of the work to be identified (highlighted in green); and

- "n is the size of the string (song)" (highlighted in orange); Moulin Depo. 88:13-15.²²
- "k" refers to the number of mismatched characters permitted in the search results returned by the search: "The problem consists of finding all instances of a pattern string P = p1, p2, p3 ... pm in a text string T t1, t2, t3 ... tn such that there are at most k mismatches (characters that are not the same) for each instance of P in T." Ghias, 6:37–41; Moulin Depo. 96:2-15.
- In the field of computer software, "O" indicates big O notation. Big O notation describes the relationship between an algorithm's execution time and other variables. In computer science, big O notation is used to describe how algorithms respond (*e.g.*, in their processing time or working space requirements) in the worst-case to changes in input size. Ex. 2009 (<u>http://en.wikipedia.org/wiki/Big_O_notation.</u>); Moulin Depo. 16:13-24 (in the field, there is "a common system of notation that's used ... when we're taking about how the search time or execution time scales with respect to the size of the database it's the so-called order of notation ... sometimes referred to as the 'big O notation.'")

216. As I explained above, the disclosed searches may be sublinear with respect to "m ... the number of pitch differences in the query." O((nlog(m))) is

²² Referring to "n" as part of the dataset to be searched (rather than the query of the work to be identified) is standard in the field. Moulin Depo. 18:2-10.

sublinear with respect to "m" (corresponding to the length of the query) because the running time is a function of log(m)). *See* Moulin Depo. 102:9-13.²³

217. The disclosed searches are never sublinear with respect to "n"—"the size of the string (song)" or the number of records in the data set ("N").²⁴ As I explained above, if a constant increase in a given variable increases the execution time of a given algorithm by a constant amount, then that algorithm scales linearly with regard to that variable. An incremental increase in the number of records in the data set, or even in the length of a given reference record ("n") in the data set, increases the execution time of every search disclosed by Ghias by a constant amount.

218. O(mn), O(kn), and O(nlog(m)) all describe algorithms whose execution times increase by a constant amount as the length of the record being searched is incrementally increased. The first to run times—O(mn) and O(kn) are linear with respect to the size of the data set being searched. My

²³ "log" stands for taking the logarithm of the following variable; so log(m) means the logarithm of m.

As I noted above, in the IPR Patents, consistent with the literature, the size of the dataset is referred to as "N" where "N" is the number of records in the dataset.

understanding, consistent with the understanding of one skilled in the art, is

confirmed by Petitioner's Declarant, see, e.g.

1-	Let's assume we have a search that's
19	execution time is $O(mn)$, where N means the size of
15	the query, N teams the size of the database of
	dataset that we're searching over.
11	What does that tell del
	A Mell, it means that the search time.
	fores, grous at most linearly.
24	1 Is it the case that this diplike a
25	sublinear search as it's used in the '13" patent?
1	A No. It says, again, it's at most linear
-	in terms of M times N.

Moulin Depo. 28:17-29:2.²⁵ The third run time—O(nlog(m))—may be sub-linear with respect to the number of pitch differences in the query "m" but is always linear with respect to "n," the size of the string (song) being searched, or the number of records in the dataset being searched. Again, my understanding, consistent with the understanding of one skilled in the art, is confirmed by Petitioner's Declarant *see*, *e.g.*:

²⁵ Petitioner's Declarant uses "data set" and "database" interchangeable in this context. Moulin Depo. 22:14-16.

```
If we have a search that is described as
20
21 set forth in Formula 6, where N refers to the size
    of the database, what does that tell us about
23 whether it's linear or sublinear?
          A Same answer as previously. You have
24
    replaced f(m) with log(m). It's just a particular
15
    function, f(m). So that would tell me that search
1
    time is at most linear in terms of N.
              If you're presented with that, does that
 2
          2
    tell you that we have a sublinear search?
 3
          à.
             In terms of N. yes.
         0
             In terms of --
          A Sorry. Let me rephrase this.
             It's at most linear.
          Q Does that tell us that we have a sublinear
    search?
10
          A it does not tell re that, because of the
    meaning of the order of notation. It says, at most,
13
   linearly.
```

Moulin Depo. 36:20-37:13.26

219. Accordingly, Ghias exclusively disclose searches that are linear-not sublinear-in relationship to the data set to be searched. My understanding is again confirmed by Petitioner's Declarant:

²⁶ These "running times" are the times it takes to run a query of length "m" against one record of the length "n" in a dataset including N records. The search time for running the same query against the full dataset would take on average N time longer, since each record in the dataset will need to be searched.

```
2 Ites the information that's presented here
is suggest to you that these to that these algorithms
are sublinear with respect to the size of the
dataset being searched!
A It dies not say that. First, there's no
database, ikay? Again, this refers to a single
song.
```

Moulin Depo. 88:22-89:3.

14	. Feea	ing this, at y	is interpret this to
18	suggest that t	nese algorithm	s are sublinear with
н. н.	respect to the	size of the d	ataset being searches?
	A No.	This, again,	reads "of the order of."
3	So it means at	most linear.	

Moulin Depo. 89:14-18.

15		Ş.	My	que	stic	$D_{\mathcal{F}}$	SII,	15 0	iti y	ou ze	ad this to
17	1531Ca	te d	oi s	1994 1994	est	tha	t the	Se 3	aiger	1 tinns	would
18	sould	be l	sec	t.:	per	fér	n <u>a s</u>	ubli	near	time	search
19	with r	espe	ect	to 1	the	512	e of	the	data	set b	e tra
24	search	ed?									
21		Ā	20.								

Moulin Depo. 90:16-21; 93:24-94:5; 98:20-25; 100:8-11; 142:5-10.

220. Petitioner's Declarant confirmed my understanding-that:

- (a) any sub linearity referenced in Ghias is with respect to "m"—the number of pitch differences in the query, not "n" the size of the string (song) or the size of the data set (N);
- (b) Ghias does not state or suggest that the size of the query is dependent on the size of the data set;
- (c) any sub linearity with respect to the query "is not relevant" to the '237 patent, and
- (d) as a result, Ghias does not disclose a search that is sublinear with respect to the size of the data set—the relevant sub-linearity inquiry for the '237 patent.

Moulin Depo. 152:20-154:2 (any sub-linearity with respect to the query "is not relevant.")

221. In reviewing Dr. Moulin's deposition, I observed that Petitioner's Declarant, Dr. Moulin, testified that:

- he clearly understood that sub-linear in the context of the '237 patent is based on the size of the data set searched, not the size of the query or the pitch differences in the query;
- (2) Ghias does not identify a search that is sub-linear with respect to the data set; and

(3) when he wrote in his Declaration that "Ghias discloses searches ... which ... are sublinear," he did not intend the Board to interpret
"sublinear" to be in the context of the '237 patent but rather in a different context irrelevant to the '237 patent.

222. As I noted above, Petitioner's Declarant understood that, consistent with my understanding, "sublinear" in the context of the '237 patent ("a concept that's common in [his] field" (Moulin Depo. 8:10-14)) is based on the size of the data set searched (N), not the size of the query or pattern to be matched ("m"):

53. I understand and agree with Petitioner's position that the term "sublinear search" means "a search whose execution time has a sublinear relationship to database size." For instance, a linear search of a 200-item database would take twice as long as a linear search of a 100-item database. By contrast, a sublinear search of a 200-item database would take less than twice as long as a sublinear search of a 100-item database, perhaps, for instance, 1.5 times as long.

Moulin Decl. (*237) ¶53.

11	Is it the case that for a search to be
12	sublinear as it's used in the '237 patent, it's not
13	enough for it to have execution time that is
14	sublinear in relationship to the size of the
15	pattern; it must also be sublinear in relationship
26	to the size of the database?
17	A When I read "sublinear" in, say, Claim 5
10	of the patent, as we just did, I understand
19	sublinear to mean in relation with the size of the
20	database. It does not say anything about in
21	relation with the size of the query.

Moulin Depo. 26:11-21.

```
1
          Q Is it the case that in doing your analysis
 -
   to determine whether or not prior art anticipated,
 3 you applied the definition that a sublinear search
 4 or a sublinear time search was one whose execution
   time has a sublinear relationship to the database
 5
   size?
 ÷
 7
        A That is correct, yes.
         Q is that the correct definition that should
 30
 9
   be applied, or are you applying the wrong
10 definition?
11
        A In my opinion, this is the correct
   definition to be used.
17
```

Moulin Depo. 24:1-12.

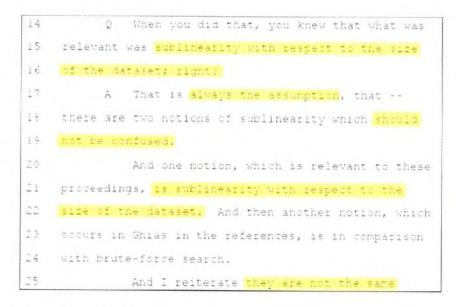
	1	16-1-12-1	Deserve is	the contraction	**
. ÷	setermine	-nether if	1.1° a 41°	en seatin	is sublinear
. E	with respe	at to the	size of th	e database	e, that reals
14	that we're	e going to	determine	execution	time
-	compared t	to the grow	th of the	database,	Na right?
.÷	2.	Yes.			

Moulin Depo. 31:13-18.

$1 \in$	Q.	Well, as you understood the term
1 ~	"sublinear	" as it's used in the patent, it's actot
18	the execut	ion time as we increase the side of the
19	database;	is that right?
20	A	In the patent, yes.
21	ų.	Yes.
	â.	Yes.

Moulin Depo. 103:16-22.

223. Petitioner's Declarant agreed with my understanding that the algorithms disclosed in Ghias do not disclose a search that is sublinear with respect to the size of the data set but instead has a sub-linear relationship to "m" the pitch differences in the query pattern:



Moulin Depo. 158:14-159:4.

18	Ş	Did y	you ever r	ead this and say	te
91	yourself,	"What	t it says	here about these	algorithms,
20	in this d	lescriț	stion of t	hese algorithms,	tells me
21	that we h	ave a	sublinear	time search"?	
22	10. 20. 20.	No.	I don't r	epresent that, no	

Moulin Depo. 91:18-22.

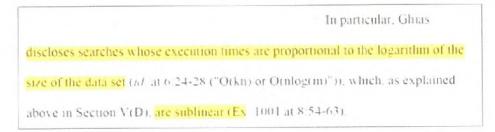
5	Q were you trying to convey that these
10	searches here in Ghias were sublinear with respect
1	to the size of the dataset?
12	A No. No. The discussion there was
13	relative to brute-force search. And it is only
14	sublinear it is known to be sublinear in that
15	sense. I do not know whether it would be sublinear
16	in the size of the database for that particular
17	algorithm.

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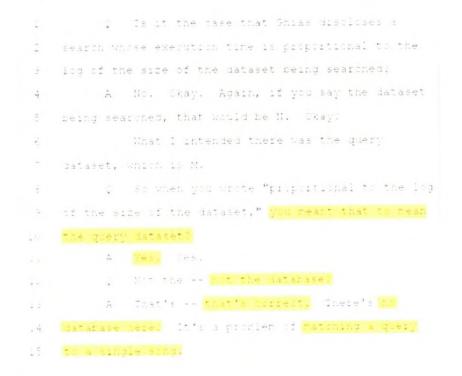
Moulin Depo. 108:9-17

224. Petitioner's Declarant testified that when he wrote the following

paragraph in his Declaration (Moulin Decl. (*237) ¶123):



he really meant sublinear with respect to the query, not the database or data set being searched:

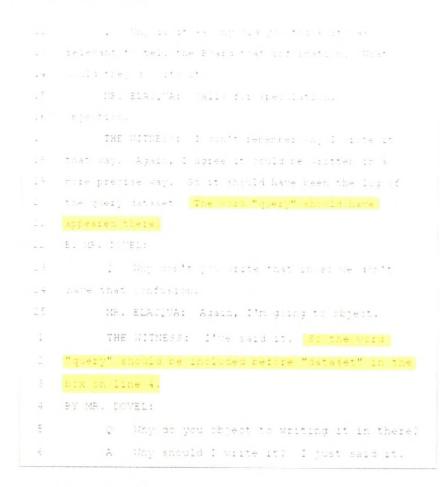


Moulin 103:1-15.

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14	Q And by "logarithm of the dataset," you
15	mean logarithm of the size of the query, not the
16	dataset to be searched; is that true?
17	A I believe we discussed that earlier.
18	Okay. Should have here it is the log, indeed, of
19	the query dataset. So log(m).
20	Q So it should this should be
21	interpreted when you write "dataset," you're
14. 14. 	what you mean is the guery dataset, not the dataset
23	to be searched?
24	A That's correct. So the logarithm of the
25	dataset is log(m), which is written below. Yes.
1	Q Which is the query dataset?
2	A That's right.

Moulin 154:14-155:2



Moulin Depo. 155:12-156:6.

A Because it's very clear. I'm saying the word "query" should have been incorporated before dataset."

Moulin Depo. 156:22-157:3.

> Well, one possible reason you wanted to give the Board this information is so that they would missead it and be misled. 8 4 That's a possibility; right? A It's not at all the -- the reason. So 10 11 it alone -- there are four documents. Some, they 12 are, like, 90 pages each. Some of the words could 13 have been better chosen. In particular, the word "query" should have been there. I have acknowledged 14 15 that. Q But assume --16 A Again, I have acknowledged that this was 17 18 not written the best way.

Moulin Depo. 157:6-18. I agree with Dr. Moulin-that the referenced passages in Ghias do not disclose a sublinear search with respect to the size of the dataset.

225. Petitioner fails to satisfy its burden of demonstrating that Ghias teaches a "sub-linear time search." As support for the "sub-linear" elements, Petitioner (and corresponding Declaration) exclusively rely on the statement addressed above—that Ghias discloses "searches whose execution times are proportional to the logarithm of the size of the data set" based on the disclosed running times of O(kn) or O(nlog(m)). Pet. (*237) at 41 (*quoting* Iwamura 6:23-35 and 6:24-28):

226. Petition:

Independent claims 1 and 5 of the '23" patent further require that the search be "sublinear" Ex. 1001 at Claims 1, 5. Ghias discloses search algorithms, that are substantially faster than "brute force" searches Ex. 1010 at 6.23-35. In particular Ghias discloses searches whose execution times are proportional to the logarithm of the size of the data set (*id* at 6.24-28 ("O(kn) or O(nlog(m)")), which, as explained above in Section V(D), are sublinear (Ex. 1001 at 8.54-63); Ex. 1004 at (123)

Pet. (237) at 41.

227. Chart in Petition:

Claim 1(b):

Ghus determines the identification of a media work by "search[ing] the b) determining, by the computer system, melody database" (2:50-59) to locate an identification of the media work using matching "sequence[s] of digitized the received features extracted from the representations of relative pitch media work to perform a sub-linear time differences," i.e., extracted features (Abstract) This is sublinear because search of extracted features of identified media works to identify a neighbor, and execution time is proportional to the logarithm of the data set, 6:24-28 ("O(nlog(m)") Ex. 1004 at # 123. This identifies a list of neighbors. i.e., "a ranked list of approximately matching melodies, as illustrated at 26" or "the single most approximate matching melody " 2:50-59, 6:60-63

Pet. (*237) at 42-43.

Claim 5(b.2):

2) determining, by the computer system, an identification of the media work using the features extracted from the media work to perform a sub-linear time search of extracted features of identified media works to identify a neighbor, and	Petitioner incorporates the above discussion of Ghias regarding Claim 1b.
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Pet. ('237) at 44.

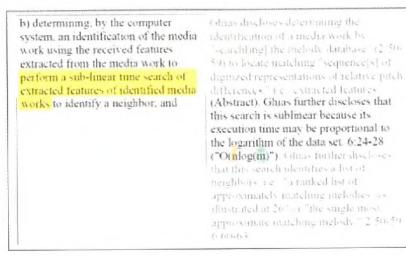
228. Declaration:

123. It is my opinion that Ghias further discloses the elements of claims 1 and 5 of the '237 patent that require that the search be "sublinear." Ex. 1001 at Claims 1, 5. In particular, Ghias discloses search algorithms that are substantially faster than "brute force" searches. Ex. 1010 at 6:23-35. In particular, Ghias discloses searches whose execution times are proportional to the logarithm of the size of the data set (*id.* at 6:24-28 ("O(kn) or O(nlog(m)")), which, as explained above in Section V(D), are sublinear (Ex. 1001 at 8:54-63).

Moulin Decl. ('237) ¶123 (the paragraph addressed above).

229. Declaration Charts:

Claim 1(b):



Moulin Decl. (*237) ¶127

Claim 5(b.2):

2) determining, by the computer system, an identification of the media work using the features extracted from the media work to perform a sub-linear time search of extracted from the media work to perform a sub-linear time search of extracted	I incorporate my above discussion of Ghias regarding Claim 1b
features of identified media works to	
identify a neighbor, and	

Moulin Decl. (*237) ¶127.27

230. As I explained above in detail, this discussion and the passage from Ghias quoted in the Petition and Declaration exclusively address sub-linearity with respect the number of pitch differences in the query ("m"), not the "size of the string (song)" ("n") (Ghias, 6:23-28), much less the size of the data set being searched ("N"), as required by a sub-linear search in the context of the '237 patent. Accordingly, although each individual comparison can be more efficient using the searches disclosed in Ghias, the computational time it takes to search the database always grows linearly with the size of the dataset. As a result, the disclosed searches in Ghias are linear, not sublinear.

231: <u>Board's concerns</u>: I now addresses the Board's specific concerns (identified in its Decision in the '237 IPR) with respect to whether Ghias discloses the claimed "sub-linear time search." In instituting Ground 1, the Board

²⁷ Petitioner's expert confirmed that the other passages that he cites relating to other claim elements do not disclose a search that is sublinear. *See, e.g.*, Moulin Depo. 151:1-5; 151:6-12; 152:3-9 (addressing Ghias 2:50-59).

preliminary found that Ghias disclosed the claimed "sublinear time search" based on the disclosed "sub-linear approximate string matching" disclosed in Ghias:

> Additionally, as we found above, the claims do not specify that the sublinear search must be performed on a subset of all of the records, and not information within individual records. As such, we are persuaded that the sub-linear approximate string matching, in Ghias, satisfies the claimed recitation of "using the received features extracted from the media work to perform a sub-linear time search of extracted features of identified media works to identify a neighbor."

Decision (*237) at 18-19.

232. As I demonstrated above, however, the "approximate string matching" algorithms disclosed in Ghias are only sub-linear with respect to the "m ... the number of pitch differences in the query" not "n... the size of the string (song))" or with respect to N, the size of the dataset:

Several Algorithms have been developed that address the problem of approximate string matching. Running times 25 have ranged from 0(mm) for the brute force algorithm to 0(kn) or 0(nlog(m), where "0" means "on the order of," m is the number of pitch differences in the query, and n is the size of the string (song).

Ghias, 6:23-28.

233. As I noted above, Petitioner's Declarant confirmed that Ghias, and the approximate string matching algorithms disclosed in Ghias, do not disclose a sublinear search with respect to the size of the data set—the relevant inquiry in the

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context of the '237 patent. Accordingly, the premise underlying the Board's preliminary finding – that the approximate string matching algorithms disclosed in Ghias have sub-linear properties with respect to the dataset—is wrong.²⁸

approximate nearest neighbor search (claim elements 9(b) and 13(b.2)).

234. As I explained above, an "approximate nearest neighbor search" is a sublinear search identifying a close match that is not necessarily the closest match." Section V(D); Decision (*237) at 9.

235. One skilled in the art would understand that Ghias does not disclose the claimed "approximate nearest neighbor search" for at least two independent reasons.

236. <u>Reason 1</u>: One skilled in the art would understand that Ghias does not disclose an "approximate nearest neighbor search" because Ghias does not disclose "identifying a close match that is not necessarily the closest match."

237. To disclose an approximate nearest neighbor search, Ghias must disclose a search that does not necessarily find the closest match. See Section

I note that Petitioner's Declarant also confirmed that searching a subset of information within individual records (e.g., not looking at "every single character in the dataset") does not establish a sub-linear search. Moulin Depo. 37:18-38:5.

V(D). "A nearest neighbor search always finds the closest point to the query. An approximate nearest neighbor search does not always find the closest point to the query. For example, it might do so with some probability, or it might provide any point within some small distance of the closest point." '237, 9:12–19. A search that always (necessarily) identifies an exact or the closest match is not an approximate nearest neighbor search because a neighbor search identifies a "close, but not necessarily exact or closest, match." Section V(D); Decision ('237) at 8.

238. Ghias discloses a search algorithm that necessarily finds the closest match. Ghias does not expressly disclose a search that does not necessarily identify an exact or closest match. And one skilled in the art would understand that such a search is not inherent (necessarily present) in Ghias.

239. Ghias teaches a search that generates three possible outputs:

(1) an exact match (Ghias 2:53-59 ("exact matching melody"));

(2) a "ranked list of approximately matching melodies" (Ghias, 2:50-59; Ghias, 6:60-63 ("a list of songs ranked by how well they matched the query"); Moulin Depo. 118:9-22); or

(3) "the single most approximate matching melody" (Ghias, 2:50-59).

Petitioner's Declarant confirmed, consistent with my understanding, that Ghias teaches these three potential outputs:

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4. ¹⁷	Gruin you agree that phias teaches sort of
	three options? Me've git - it's doing to produce
1.5	the exact ration it's gring to produce the rost
19	approximate matching; or it's going to produce this
	ranked list?
21	A Yes.

Moulin Depo. 341:16-21.

240. For all three outputs, Ghias always identifies an exact or the closest match:

241. (1) <u>exact match</u>: If the search produces an exact match, it necessary produces an "exact or closest, match" and therefore does not disclose an "approximate nearest neighbor search." Petitioner's Declarant agreed with my understanding:

If it produces the exact matching melody, 24 would you agree that Shias teaches providing or 15 identifying the closest ratch? 1 A Yes.

Moulin Depo. 341:23-342:1.

242. (2) <u>ranked list</u>: If the search produces a ranked list, it necessarily identifies as part of the ranked list either an exact match (if there is one) or the closest match—*i.e.*, the top ranked match—and therefore does not disclose an "approximate nearest neighbor search" that does not necessarily identify an exact or the closest match. At the top of the ranked list (*i.e.*, the number 1 ranked match

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in the list) is an exact or the closest match. For example, assume for illustrative purposes that the work to be identified is 500. Assume that the list outputs in ranked order:

Ist closest: 502 2nd closest: 510 3rd closest: 530 and 4th closest: 570.

The ranked list identified the closest match as 502. The closest match will never be excluded from the list of matches returned. As another example, assume that the list outputs in ranked order:

> 1st closest: 500 2nd closest: 510 3rd closest: 530 and 4th closest: 570.

In this example, the ranked list identified an exact match as 500. The exact match will never be excluded from the list of matches returned.²⁹ Accordingly, this

²⁹ The list of matches within a given error-tolerance includes the full list of matches except those matches outside a given error-tolerance. Because the closest match is among the matches retrieved from the database, and the closest match is

approach necessarily identifies the closest match and therefore is not an

"approximate nearest neighbor search."

243. Petitioner's Declarant confirmed, consistent with my understanding,

that the ranked list approach identifies the closest match:

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     inter that produces a tablet livet, that are then
   1 107 for identity the mat hothat bas seen generate.
 4
          of it contractely by "mapping are a
    Datches that are closed; it's doing to identify the
    te that it is seemed to be the lower match
        A 2 if the end simelt where it of it a
        A Stat wall output the list of what it
14 Indiates I deeps are the closest matches.
         3 And 5 that list, it's also going t
   Lightify the the that is the charget wat
11
         A That is weened by the algorithm to be
    is the appl Ximate algorithm to be the close t
    matet.
```

Moulin Depo. 356: 2-21.

not subsequently excluded from that list, the closest match will always be among the list of matches returned.

244. (3) <u>single most approximate matching melody</u>: If the search identifies the single most approximate matching melody, it necessarily identifies the closet match and is therefore not the claimed "approximate nearest neighbor search." Petitioner's Declarant agreed with my understanding:

Q If it returns -- if it identifies anything 9 as a -- as a match, it's going to be identifying the 10 closest possible match; right? A Yes. 11

Moulin Depo. 345:16-346:11.

245. Petitioner's expert confirmed that for all three outputs, Ghias teaches a system that will always (necessarily) identify the closest match. Moulin Depo. 352:22-353:2. Accordingly, for all three potential outputs, Ghias necessarily identifies an exact or the closest match. Ghias does not disclose an "approximate nearest neighbor search" which identifies "a close, but not necessarily exact or closest, match."

246. <u>Reason 2</u>: Ghias does not disclose an "approximate nearest neighbor search" because Ghias does not disclose a sublinear search. As I explained above, an "approximate nearest neighbor search" is "one example" of a "sublinear search." Section V(D). Also, as I demonstrated above, Ghias does not disclose a "sublinear search." Section VI(B)(1). Accordingly, Ghias does not disclose the claimed "approximate nearest neighbor search."

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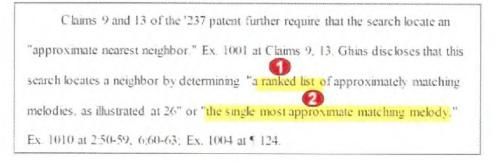
Google Ex. 1020

247. The Petition, Declaration, and corresponding charts fail to demonstrate that Ghias discloses the claimed "approximate nearest neighbor search." The Petition and corresponding declaration assert that Ghias discloses the "approximate nearest neighbor search" because it produces:

(1) "a ranked list of approximately matching melodies" (labeled **0**); or

(2) "the single most approximate matching melody" (labeled):

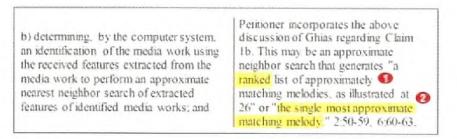
248. Petition:



Pet. ('237) at 42.

249. Petition Charts:

Claim 9(b):



Pet. ('237) at 45.

NETWORK-1 EXHIBIT 2005 Google Inc. v. Network-1 Technologies, Inc. IPR2015-00343

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Claim 13(b.2) (referencing claim element 9(b)):

2) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest neighbor search of extracted features of identified media works, and	Petitioner incorporates the above discussion of Ghias regarding Claim 9b.
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Pet. at 46.

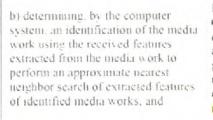
250. Declaration:

124 It is my opinion that Ghias further discloses the elements of claims 9
and 13 of the '237 patent that require that the search locate an "approximate nearest
neighbor " Ex 1001 at Claims 9, 13. In particular, Ghias discloses that the search
locates a near or nearest neighbor by determining "a ranked list of approximately
matching melodies, as illustrated at 26" or "the single most approximate matching
melody " Ex. 1010 at 2:50-59, 6:60-63.

Moulin Decl. (*237) ¶124.

251. Declaration Charts:

Claim 9(b):



I incorporate my above discussion of Ghias regarding Claim 1b. Ghias further discloses that this may be an approximate neighbor search that generates "a ranked list of approximately matching melodies, as illustrated at 26" or "the single most approximate matching melody " 2:50-59, 6:60-63

Moulin Decl. (*237) ¶127.

Claim 13(b.2) referencing claim element 9(b)):

2) determining, by the computer	1 incorporate my above discussion of
system, an identification of the media work using the received features extracted from the media work to perform an approximate nearest	Ghias regarding Claim 9b.
neighbor search of extracted features of identified media works, and	

Moulin Decl. (*237) ¶127.

252. One skilled in the art would understand that neither of the cited passages discloses the claimed "approximate nearest neighbor search" because, as described above, both the ranked list and single most approximate matching melody always identify the closest match. I address each passage in turn:

253. Passage 1:

The query engine 24 searches the melody database 14 and outputs a ranked list of approximately matching melodies, as illustrated at 26. A preselected error tolerance may be applied to the search. The query engine 24 may of course alternatively be programmed to output the single most approximate matching melody or, if desired, to output an exact matching melody. However, by searching for an approximate matching melody, as hereinafter discussed, various forms of anticipated errors may be taken into account.

Ghias, 2:50-59. As noted in the Petition and Declaration, this passage states that the search "outputs a ranked list of approximately matching melodies, as illustrated at 26" or "the single most approximate matching melody." As I explained above, neither approach discloses the claimed "approximate nearest neighbor search." An "approximate nearest neighbor search" must identify "a close, but not necessarily exact or closest, match" Section V(D); Decision ('237) at 8. Both outputs

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disclosed in this passage necessarily disclose an exact or the closest match and, therefore, are not an "approximate nearest neighbor search."

254. Passage 2:

The computer 16 may desirably be programmed so that, for a given query, the database 14 returns a list of songs ranked by how well they matched the query, not just one best match.

Ghias, 6:60-63. This passage also does not disclose a neighbor search. As I explained above, a "list of songs ranked by how well they matched the query" necessarily identifies an exact or the closest match, and specifically identifies such a song as the top-ranked song.

255. Moreover, under the proper construction of "approximate nearest neighbor search," the search must be a sub-linear search. '237, 9:12-19 (an approximate nearest neighbor search is an "example of a sub-linear time search"); Section V(D). As demonstrated above, these passages disclose a linear (rather than sublinear) search.

256. <u>Board's concerns</u>: I now address the Board's specific concerns (identified in its Decision) with respect to whether Ghias discloses the claimed "approximate nearest neighbor search." In instituting Ground 2 of the '237 IPR, the Board found that Ghias disclosed the "approximate nearest neighbor search"

because the error-tolerance search disclosed in Ghias "allows the user to identify sets of songs that contain similar melodies:"

Ghias provides that "[1]he number of matches that the database 14 should retrieve depends upon the *error-tolerance* used during the keysearch," and "the user can perform a *new query on a restricted search list consisting of songs just retrieved.* This allows the user to identify sets of songs that contain similar melodies." Ex. 1010, 6:63–65, 7:5–8 (emphases added). Thus, Ghias makes clear that the search need not be exhaustive, as Patent Owner has argued, and will act to "identify[] a close, but not necessarily exact or closest, match," per our claim construction.

Decision ('237) at 18-19. The Board did not explain, however, how "Ghias makes clear" that the search in Ghias will "identify[] a close, but not necessarily exact or closest, match" as required by an "approximate nearest neighbor search."

257. The Board noted that using an "error-tolerance," the user can adjust the number of output matches ("The number of matches that the database 14 should retrieve depends upon the error-tolerance used during the key search." Ghias, 6:63-65); and a new query can be performed on the restricted list ("If the list is too large, the user can perform a new query on a restricted search list consisting of songs just retrieved." Ghias, 7:5-8). But nothing in these passages or anywhere else in Ghias states or even suggests that the output of the initial list or the output of the restricted search will "identify a close, but not necessarily exact or closest, match." As I explained above, no such search is expressed in Ghias or is

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inherent (*i.e.*, necessarily present). Rather, the search will always ("necessarily") identify an exact or closest match. Accordingly, Ghias does not disclose the claimed "approximate nearest neighbor search."³⁰

C. '237 Ground 3: The instituted claims of the '237 patent are not obvious over Iwamura and Chen.

258. It is my understanding that if a combination of two references fails to teach an important claimed element, it is not possible for that combination to render the claim obvious. That is, assuming one of ordinary skill would have thought to combine prior art references, those references would still be missing an important element and therefore, even with the combination, one of ordinary skill would still not possess the invention.

259. Any combination of Iwamura with Chen would still be missing the same elements addressed above in Ground 1.

260. Ground 3 is directed to only dependent claims 26 and 27 which depend either directly or indirectly on independent claim 25; and claims 34 and 35 which depend either directly or indirectly on independent claim 33. Pet. (*237) at

³⁰ An approximate nearest neighbor search could miss one or more of the closest matches in the returned search results. The searches disclosed in Ghias never purport to miss one or more of the closest matches in the returned results.

53-56; Decision (*237) at 22. Ground 3 presents two alternative grounds—that the dependent claims "are obvious over Iwamura alone, or alternatively, over Iwamura in view of Chen." Pet. (*237) at 53.

261. As I demonstrated above, Iwamura does not disclose key elements from the independent claims upon which Ground 3 is based (claims 25 and 33) including:

- "non-exhaustive search ... to identify a near neighbor" (claim 25(b.2); and
- "approximate nearest neighbor search" (claim 33(b.2)).

I note that Petitioner does not rely on Chen for these elements. Pet. (*237) at 53-56; Moulin Depo. 371:17-20 (addressing sublinear); Moulin Depo. 372:2-4 (addressing non-exhaustive); Moulin Depo. 372:5-7 (addressing approximate nearest neighbor search).

262. Moreover, I note that Petitioner does not assert that these missing elements are obvious in light of Iwamura but rather continues to assert that they are expressly disclosed in Iwamura. *See e.g.*, Pet. ('237) 54 ("For the reasons expressed in Ground 1 [anticipation based on Iwamura], Iwamura discloses all elements of claims 25 and 33."). Accordingly, Ground 3 fails at least because the elements from the independent claims addressed above are missing from Iwamura and the Petition does not identify any basis for correcting these deficiencies based on either Iwamura or Chen.

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VII. '988 patent.

263. The Board instituted the '988 IPR based on three Grounds:

- <u>Ground 1</u>: Claims 15 17, 21-23, 28, 31, and 51 under 35 U.S.C. § 102(b) as anticipated by Ghias;
- Ground 2. Claims 22, 24–26, and 52 under 35 U.S.C. § 103(a) as obvious over Ghias; and
- Ground 3: Claims 15–17, 21, 23, 27, 28, 31–33, 38, and 51 under 35 U.S.C.
 § 102(e) as anticipated by Iwamura;

Decision ('988) at 22. 1 note that the only instituted independent claim is claim 15. I address each Ground in turn.

A. '998 Ground 1: The instituted claims of the '988 Patent are not anticipated by Ghias.

264. The single independent claim of the '988 patent instituted for trial requires a "non-exhaustive search identifying a neighbor." '988, claim 15. Ghias does not disclose (1) a non-exhaustive search, (2) a search identifying a neighbor, or (3) determining an action based on the identification. I address each deficiency in turn.

1. non-exhaustive search (claim element 15(b)).

265. As I explained above in detail (Section V(B)), a "non-exhaustive search" is "a search that locates a match without a comparison of all possible matches."

266. One skilled in the art would understand that Ghias teaches an exhaustive search that compares the work to be identified (user input 23) with "all the songs" in the database—*i.e.*, "all possible matches." One skilled in the art would understand that all "possible matches" in the system disclosed in Ghias are all of the songs in the database. My understanding is confirmed by Petitioner's Declarant:

19 Q Is it the case that the set of all 20 possible matches for Ghias are the set of the 21 musical works in the database? 22 A Yes.

Moulin Depo. 325:19-22. Ghias discloses a search that compares the work to be identified ("user input") with all possible matches—"all the songs" in the database:

In order to search the database, songs in the database 14 are preprocessed to convert the melody into a stream of the previously discussed U,D,S characters, and the converted user input (the key 23) is compared with all the songs.

Ghias, 5:66-6:2. As Petitioner's Declarant acknowledged when addressing the paragraph from Ghias quoted above:

2 - Weil, it says, "In true: to sealch the database, sings are preprioressed to convert the 14 relidy into a stream of characters"; right) A Fight. . And it says, "The indiverted user input is . "organed with all the songs"; signt? 4 A Yeany That past then makes it clear it's

Moulin Depo. 339:23:-340:5.

Ê	2	Ices Shias teach doing a search by	
1	performin	g a comparison with all the possible song	
11	that are	possible matches in the database?	
ÿ	Ĩ4	Yes, it does say all the songs.	

Moulin Depo. 340:6-9.

4	Q But what you've identified in Ghias, in
5	each case. Shias is going to be searching each of
é	the records in the database; right?
-7	a Ves.
30	Q Would it be the case that the Ghias search
9	is going to be performing a comparison to each of
10	the melodies that are possible matches in the
11	database?
	A It does a comparison, yes, to each of
- 2	them.

Moulin Depo. 323:4-13.

267. The user input (23) is not compared with some songs in the melody database (14); rather, it "is compared with all the songs." Ghias does not disclose a

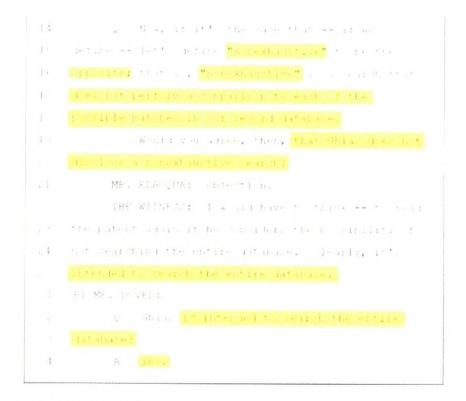
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search algorithm that does not compare the query to every record in the reference data set. Petitioner's Declarant confirmed my understanding—that the search disclosed in Ghias compares the song to be identified with each record in the database and is therefore not "non-exhaustive"—"a search that locates a match without a comparison of all possible matches" (Section V(B)); Decision (*998) at

7):

115	Let's assume we define "exhaustive search"
4	as a search that does a comparison to each of the
5	possible matches in the database that we're
6	searching over.
77	In that instance, if we have that
8	definition, would you agree that Ghias does perform
9	an exhaustive search?
10	MR. ELACQUA: Objection.
11	THE NITNESS: Under your flawed definition,
12	yes, it would.

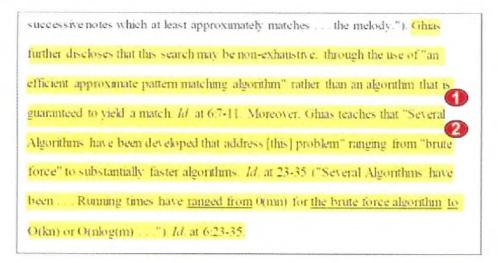
Moulin Depo. 327:3-12.



Moulin Depo. 327:14-328:4.

268. The Petition and corresponding Declaration fail to demonstrate that Ghias discloses a non-exhaustive search.

269. <u>Petition</u>: As support for the claimed "non-exhaustive search," the Petition relies on the following assertions (and corresponding references to Ghias) labeled **1** and **2**:



Pet. (*988) 9-10.

270. <u>Petition Charts</u>: The charts in the Petition rely on the same assertions and passages from Ghias: Petitioner's chart for claim 15, element [c] incorporates the chart for claim 1, element [c]:

 b) electronically determining an identification of the electronic work based on the extracted features, wherein the identification is based on a non-exhaustive search identifying a neighbor; 	Petitioner incorporates the above discussion of Ghias regarding Claim 1c.
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------

Pet. ('988) at 14. The chart for claim 1, element [c], in turn, provides:

Ghus receives and outputs at the computer. which is a portable chent device (Ex-1004 at (73), a list of identifications of electronic works 2 50-52, 6 60-63, 7 4-5, 8 26-28. c) recening at the portable chent. 8.61-63 Such identifications are determined device from the one or more by "searching the melody database 14" to servers an identification of the locate a matching melody 2 50-59, 6 60-63, electronic work based on the 7.4-5. Abstract, 8.26-28. 8.61-63. This extracted features, wherein the search may employ a non-exhaustive – 🌒 identification is based on a non-"approximate pattern matching algorithm" or exhaustive search identifying a another algorithm that operates faster than a 🚱 neighbor. brute force search 67-11, 623-35. This non-exhaustive search identifies a neighbor. i.e., "a ranked list of approximately matching melodies " 2.50-59, 660-63

Pet. (*988) at 12.

271. <u>Declaration</u>: Petitioner's Declaration relies on the same assertions and passages from Ghias:

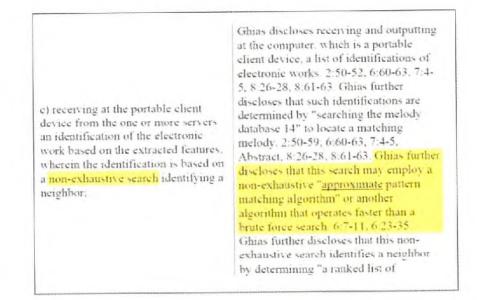
relative pitch differences between successive notes of the melody."). Ghias further discloses that this search may be non-exhaustive. Specifically, Ghias teaches that "it is considered desirable to use an efficient approximate pattern matching algorithm" rather than an algorithm that is guaranteed to yield a match Id at 6:7-11. Moreover, Ghias teaches that "Several Algorithms have been developed that address [this] problem" ranging from "brute force" to substantially faster algorithms. Id at 23-35 ("Several Algorithms have been developed that address the problem of approximate string matching. Running times have ranged from 0(mn) for the brute force algorithm to O(kn) or O(nlog(m), where 'O' means 'on the order of,' in its the number of pitch differences in the query, and n its the size of the string (song) ") ¹ Id at 6:23-35. Because these algorithms are faster than brute force searches, they are non-exhaustive under Petitioner's construction.

Moulin Decl. (*988) *69-70.

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272. Declaration Charts: Finally, the charts in the Declaration also rely on

the same assertions and passages from Ghias:



Moulin Decl. ('988) ¶75.

273. These are the only passages from Ghias cited by the Petitioner and Declarant to support the sub-linear claim elements. Moulin Depo. 113:15-21. The assertions relating to these passages fails to: (a) apply Petitioner's construction (or any other construction) of non-exhaustive to Ghias; or (b) explain how an "approximate string matching algorithm" is expressly or inherently a nonexhaustive search. One skilled in the art would understand that neither the assertions nor the passages from Ghias disclose the claimed non-exhaustive search. I address each in turn.

274. Passage 1:

For performing the key-search within the database 14, it is considered desirable to use an efficient approximate pattern matching algorithm. By "approximate" is meant that the algorithm should be able to take into account various forms of errors.

Ghias, 6:7-11. First, this passage does not state that the algorithm is not guaranteed to yield a match (as interpreted by Petitioner). Second, and more importantly, the described algorithm does not state (or even suggest) that all possible matches in the database are not searched. The passage does not state that all matches are not considered, or even that all data in all possible matches is not considered. My understanding is confirmed by Petitioner's Declarant:

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gaing t	te be	uein	a =	seator	±5.1 €	a t. wh	ere ve leave
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Moulin Depo. 347:13-17.

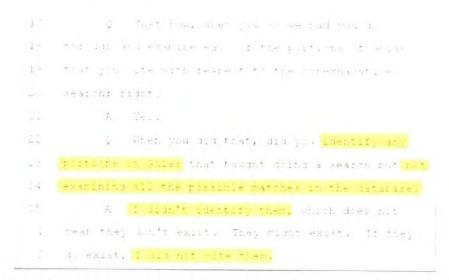
275. Passage 2:

Several Algorithms have been developed that address the problem of approximate string matching. Running times have ranged from 0(mn) for the brute force algorithm to 0(kn) or 0(nlog(m), where "0" means "on the order of," m is the number of pitch differences in the query, and n is the size of the string (song). See Ricardo Baeza-Yates and G. H. Gonnet, "Fast String Matching with Mismatches," *Information and Computation*, 1992. A preferred algorithm which is considered to offer better performance in general for this purpose is that described in Ricardo A. Baesa-Yates and Chris II. Perieberg, "Fast and Practical Approximate String Matching, "*Combinatorial Pattern Matching, Third Annual Symposium*," pages 185–192, 1992.

Ghias, 6:23-35. One skilled in the art would understand that the "approximate string matching" algorithms discussed in this passages involve matching a work with a record in the database, where the work to be identified includes an "error" so that "various forms of errors" would not prevent a proper match from being identified. The "approximate string matching" algorithm is applied when the work melody "is compared with all the songs" in the database and all of the data within each record. Ghias, 5:66-6:2; Moulin Depo. 347:13-17. This passage discusses comparing the work with a single record in the database.

276. Accordingly, Ghias does not disclose a search that would even meet Petitioner's improper construction of "non-exhaustive search," because Ghias does not search less than "all possible matches" or even less than "all data within all possible matches."

277. I observed that Petitioner only cited the two passages quoted above as support that Ghias discloses the claimed non-exhaustive search. Petitioner's expert confirmed my observation:



Moulin Depo. 332:17-333:2. As I demonstrated above, these two passages fail to disclose the claimed non-exhaustive search. Accordingly, Petitioner failed to satisfy its burden of establishing that Ghias discloses the claimed non-exhaustive search.

278. Moreover, Petitioner's expert confirmed that other passages from Ghias cited in his Declaration—in an attempt to establish other claimed elements also do not establish the claimed non-exhaustive search. Moulin Depo. 330:19-331:24; 239:22-25 (2:50-52 "does not teach excluding a portion of the database from our search"); Moulin Depo. 330:15-18 (2:50-52 ("Q. Does Ghias have any portion in where it teaches affirmatively searching only part of the database. A. Not in that sentence, no."); Moulin Depo. 330:1-14 (2:50-52 (the "natural inference" from the statement that the "query engine 24 searches the melody database 14" is that "it's going to search the entire database"); Moulin Depo.

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334:2-21 (Q. "[D]oes Ghias teach looking at only a portion of the database? ... A. It does not do that in this paragraph."); Moulin Depo. 337:7-338:17.

279. <u>Board's concerns</u>: I now address the Board's specific concerns (identified in its Decision in the '988 IPR) with respect to whether Ghias discloses the claimed non-exhaustive search. I note that in instituting Ground 2, the Board did not rely on the arguments presented by Petitioner and its Declarant or the passages from Ghias quoted by Petitioner and its Declarant in an attempt to establish the claimed non-exhaustive search. Instead, the Board initially found that Ghias disclosed the "non-exhaustive" search because the search disclosed in Ghias could produce a list of matches based on an error-tolerance and the user can perform a "new query on a restricted search list consisting of songs just retrieved:"

On the present record, we are not persuaded by Patent Owner's arguments. Ghias provides that "[1]he number of matches that the database 14 should retrieve depends upon the *error-tolerance* used during the key-search." Ex. 1010, 6:63–65 (emphasis added). Ghias further provides that "the user can perform a *new query on a restricted search list consisting of songs just retrieved*. This allows the user to identify sets of songs that contain similar melodies." *Id.* at 7:5–8 (emphasis added). Thus, Ghias makes clear that the search need not be exhaustive, as Patent Owner argues, and will act to "identify[] a close, but not necessarily exact or closest, match." per our claim construction. Additionally, given the

Decision ('988) at 12. There are two reasons why the Board's reliance on the "new query on a restricted search list" does not satisfy Petitioner's burden of demonstrating that the instituted clams are unpatentable based on Ghias.

280. First, had the concept of a new second search based on the restricted list (and these passages from Ghias cited by the Board) disclosed the claimed "nonexhaustive search" (as I demonstrated below, they do not), it is my understanding that it could be improper for the Board to rely on these passages in finding the challenged claims unpatentable because these passages were not identified by the Petitioner as support for the non-exhaustive search.

281. I note that Petitioner never asserted (in the Petition, charts, or Declaration) that Ghias discloses a non-exhaustive search because the "user can perform a new query on a restricted search list consisting of songs." The Petition does not even mention the words or concepts emphasized by the Board in its Decision and that form the basis for the Board's preliminary finding that Ghias discloses a non-exhaustive search: "error-tolerance" and "restricted search list consisting of songs just receive." The only references to Ghias presented by the Petitioner for the claimed non-exhaustive search are Ghias, 6:7-11 and 6:23-35 addressing approximate string matching, not performing a "new query on a restricted search list consisting of songs just retrieved" based on an error tolerance. Petitioner's Declarant did not "cite anything in [his] Declaration that teaches, in

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Ghias, performing a search that returns a list of ranked matching songs and then performing a second search on that list." Moulin Depo. 146:21-147:21.

282. 1 note that the Board, however, relied exclusively on two completely different passages from Ghias not cited by Petitioner—Ghias, 6:63-65 and 7:5-8. Decision ('988) at 12. One skilled in the art would understand that these passages address a different concept than the approximate pattern matching concept identified by Petitioner as support for the nonexhaustive search element.

283. Second, using a "new query" on the "restricted search list consisting of songs just received" does not disclose the claimed "non-exhaustive search." A "non-exhaustive search" is "a search that locates a match without a comparison of all possible matches." *See* Section V(B), ¶¶X. The restricted search can be viewed in one of two ways.³¹ Under either view, Ghias does not disclose a non-exhaustive search. I address each view in turn.

284. <u>First view</u>: Under the first view, the search to identify the record that matches the song being hummed is viewed as a single search with two stages. Under this view, the second search on the "restricted list" is not an independent search—the two stages of the search are not independent. Rather, the search on the

³¹ Ghias provides no details or information about the search on the restricted search list.

"restricted list" is the second stage of a two-stage search, dependent on the first stage. *See* Moulin Depo. 336:9-15. The second search depends on the first to generate a candidate set. A single work, *i.e.*, the song being hummed (not two or more works), is being identified in the two-stage search. The two stages refine the identified matches; the second stage does not identify any new matches.

285. To constitute a "non-exhaustive search" under this view, the twostage search process disclosed in Ghias would have to conduct the search without comparing the work to be identified with all possible matches in the dataset. One skilled in the art would understand that the two-stage search disclosed in Ghias is exhaustive because the first stage compares the query to all possible matches in the dataset —"all the songs." Ghias, 5:66-6:2. My understanding is confirmed by Petitioner's Declarant:

3 Q And the user of the user search has
4 already done a comparison to the other songs in the
5 database; right?
6 A In the first stage, you know, the one that
7 produced the list, the search was on the entire
9 database presumably, yes.
9 A To we have a two-stage search. The first
9 stage, we so a comparison of all possible matches in
9 the database; right?
10 A Yes.

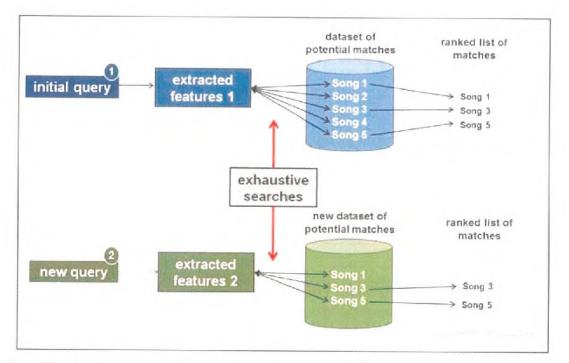
Moulin 336:3-336:12.

```
Q Does it teach doing a search without doing
é
7 a comparison of all the possible matches?
         A You mean all the possible entries in the
$
   original database?
9
10
        Q Yes.
         A No, it does not teach that.
11
          Q The entries in the original database,
12
13 those are the possible matches?
          A Yes.
14
```

Moulin Depo. 338:6-14.

286. Under this view, the query on a restricted search list is part of a broader search of every record in the database, which compares the work to be identified with all possible matches—all records in the data set.

287. <u>Second view</u>: Alternatively, the second search could be viewed as an independent second search. As disclosed in Ghias, the second search is based on a "new query"—"the user can perform a <u>new query</u> on a restricted search list." Ghias, 7:4-8. The two searches, the first based on an initial query, and the second, based on a second "new query," is reflected in this illustration:



To refine the list of potential matches, the "new query" (2) disclosed in Ghias must be different from the original query (1). This is because Ghias does not teach an alternative search algorithm for searching the restricted list. Rather, Ghias teaches that the same search algorithm is applied to the "new query" (2) that was previously applied to the initial query (1). If the initial query (1) is applied to the restricted list using the same algorithm, the search would produce the same restricted list rather than refine the search as intended by Ghias.³² Although the

³² If the query remains constant—the query is not changed—but a different algorithm is applied to the restricted list, this would constitute a single search with