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1	Divsalar's repeat irregular, one way would be to	05:19:02
2	partition the information bits into subblocks and	05:19:04
3	repeat the bits in each block a different number of	05:19:08
4	times, right?	05:19:11
5	A. One of the many ways of adding	05:19:12
6	irregularity would be to add irregularity in a way	05:19:18
7	of changing the number of times things are repeated.	05:19:22
8	Q. Okay.	05:19:26
9	MR. GLASS: And just objection to previous	05:19:26
10	question as calls for a legal conclusion.	05:19:29
11	Go ahead.	05:19:31
12	BY MR. DOWD:	05:19:31
13	Q. And what's shown in Figure 2 of Frey is	05:19:31
14	that you've got a group of bits that you have	05:19:35
15	partitioned into subblocks F1, F2, F3, through FD,	05:19:39
16	and you repeat the bits in each block a different	05:19:46
17	number of times, correct?	05:19:49
18	MR. GLASS: Same objection. And outside	05:19:50
19	the scope.	05:19:52
20	THE WITNESS: It shows nodes that have	05:19:52
21	different repetitions -- whatever exactly that means	05:19:56
22	in this paper -- attached to them.	05:20:01
23	BY MR. DOWD:	05:20:04
24	Q. So if I took the concept from Frey '99 of	05:20:06
25	partitioning bits into subblocks where I repeat each	05:20:10

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1	subblock a different number of times and I apply	05:20:14
2	that to the repeater of Divsalar Figure 3, the	05:20:18
3	result would be an irregular repeat, correct?	05:20:22
4	MR. GLASS: Objection. Vague. Calls for	05:20:25
5	a legal conclusion.	05:20:27
6	THE WITNESS: No, it's false.	05:20:28
7	MR. GLASS: Calls for a legal conclusion.	05:20:30
8	Incomplete hypothetical.	05:20:31
9	Go ahead.	05:20:32
10	BY MR. DOWD:	05:20:34
11	Q. So --	05:20:34
12	A. It's false.	05:20:33
13	Q. So are you saying that if I take the input	05:20:35
14	block to the repeater in Figure 3, divide that into	05:20:40
15	subblocks and repeat the bits of each subblock	05:20:46
16	different numbers of times, that's not an irregular	05:20:50
17	repeat; is that your testimony?	05:20:52
18	A. That is not what is written --	05:20:53
19	MR. GLASS: Same objections.	05:20:53
20	THE WITNESS: That is not what is written	05:20:54
21	in Figure 2. What is written in Figure 2 is that	05:20:56
22	you take the code word bits, which is something	05:20:59
23	entirely different.	05:21:02
24	BY MR. DOWD:	05:21:03
25	Q. Well, try my question. My question is, if	05:21:03

1   I take the input bits to the repeater in Figure 3,   05:21:06

2   divide them into subblocks, and repeat each subblock   05:21:11

3   a different number of times, then I have an   05:21:14

4   irregular repetition, correct?   05:21:18

5   MR. GLASS: Same objections. Asked and   05:21:19

6   answered.   05:21:21

7   THE WITNESS: What you're asking me is if   05:21:21

8   I take a repeater accumulated code and make it   05:21:24

9   irregular, is it irregular? Yes.   05:21:29

10   BY MR. DOWD: 05:21:32

11   Q.   Okay. And so taking a set of input bits,   05:21:32

12   dividing that into subblocks and repeating each   05:21:40

13   subblock a different number of times, that to you is   05:21:42

14   the definition of an irregular code?   05:21:45

15   MR. GLASS: Calls for a legal conclusion.   05:21:47

16   Outside the scope.   05:21:48

17   THE WITNESS: I have no opinion on that.   05:21:48

18   BY MR. DOWD: 05:22:04

19   Q.   Now, is it your position that Dr. Frey and   05:22:04

20   Dr. Divsalar were in different groups that didn't   05:22:07

21   talk to each other?   05:22:09

22   A.   This would be best posed to them. I have   05:22:10

23   absolutely no idea.   05:22:12

24   Q.   Okay. So to the best of your knowledge,   05:22:13

25   Dr. Frey and Dr. Divsalar may well have talked to   05:22:16

1	each other?	05:22:18
2	A. I could speculate, but I prefer not to.	05:22:19
3	Q. Well, we don't have to speculate.	05:22:23
4	MR. DOWD: Let's mark as Exhibit 22, a	05:22:30
5	copy of a document Caltech24021, it's an e-mail from	05:22:33
6	Dr. Frey to Dr. Divsalar.	05:22:39
7	(Urbanke Exhibit 22 was marked for	05:22:41
8	identification and attached to the	05:22:41
9	transcript.)	05:22:53
10	BY MR. DOWD:	05:22:53
11	Q. Do you have Exhibit 22?	05:22:53
12	A. Yes.	05:22:54
13	Q. This is an e-mail that Dr. Frey sent to	05:22:54
14	Dr. Divsalar in December of '99, right?	05:22:57
15	A. The date reads: 12/8/1999.	05:23:05
16	Q. And he says -- he references the irregular	05:23:09
17	turbo codes work that he's been doing, right?	05:23:14
18	A. He -- in -- in there it's written	05:23:18
19	"irregular turbo codes" is two of the words that	05:23:22
20	appear in the e-mail; that is correct.	05:23:24
21	Q. And he asks:	05:23:28
22	"Dr. Divsalar, have you had a chance	05:23:34
23	to look through the Allerton paper?"	05:23:36
24	Right?	05:23:39
25	A. That is a sentence that appears; that's	05:23:41

1   correct.   05:23:44

2   Q.   Exhibit 21 is the irregular turbo codes   05:23:44

3   paper from the 1999 Allerton conference, correct?   05:23:48

4   A.   Whether he refers to the turbo code paper,   05:23:52

5   I have no idea. It doesn't say specifically.   05:23:55

6   It says -- he mentions: Have you looked   05:23:57

7   through the Allerton paper? Which paper he refers   05:24:00

8   to, I have no idea.   05:24:03

9   Q.   My question was, Exhibit 21 is the   05:24:04

10   irregular turbo codes paper Dr. Frey presented at   05:24:08

11   Allerton in 1999, correct?   05:24:11

12   A.   Reference 21 is a code -- a paper   05:24:14

13   entitled: "Irregular Turbo Codes," which was   05:24:23

14   published or which was presented presumably at the   05:24:27

15   Allerton conference in 1999.   05:24:32

16   Q.   Okay. And if we return to Exhibit 22, he   05:24:34

17   says: 05:24:38

18   "Regardless, it would be interesting   05:24:38

19   to extend the work that you and Bob have   05:24:40

20   done to the case of irregular turbo   05:24:42

21   codes."   05:24:42

22   Have I read that correctly?   05:24:46

23   A.   Yes.   05:24:47

24   Q.   If we go to Exhibit 6, that's the Divsalar   05:24:48

25   paper we've been talking about so far today, right?   05:24:54

1	A. Yes.	05:24:57
2	Q. And two of the authors on that paper are	05:24:58
3	Dr. Divsalar and Bob McEliece, right?	05:25:01
4	A. That is correct.	05:25:05
5	Q. And so at this time Divsalar and McEliece	05:25:09
6	were working together on RA codes, correct?	05:25:13
7	A. Their main motivation was to extend what	05:25:16
8	was --	05:25:18
9	THE REPORTER: I'm sorry. Start over.	05:25:18
10	THE WITNESS: Their main motivation was to	05:25:20
11	extend what was called the interleaver gain	05:25:22
12	conjecture, I believe, to turbo codes. And they	05:25:27
13	succeeded in the RA paper to do that for the very	05:25:30
14	specific case of RA codes.	05:25:36
15	BY MR. DOWD:	05:25:39
16	Q. Okay. So --	05:25:40
17	A. That is what their main work was at that	05:25:40
18	time.	05:25:44
19	Q. So my question was, at that time	05:25:44
20	Dr. Divsalar and Dr. McEliece, what they were	05:25:47
21	working on together was RA codes, right?	05:25:52
22	A. They were working on the weight	05:25:53
23	distribution problem.	05:25:56
24	Q. They were working on a problem that	05:25:56
25	resulted in the RA codes that we have in Exhibit 6,	05:25:58

1	right?	05:26:02
2	MR. GLASS: Objection. Asked and	05:26:02
3	answered.	05:26:04
4	THE WITNESS: As it's written even in the	05:26:04
5	paper, I believe, their motivation for looking at it	05:26:07
6	and their main work for doing it was to solve the	05:26:10
7	interleaver gain component conjecture.	05:26:14
8	BY MR. DOWD:	05:26:17
9	Q. Okay.	05:26:18
10	A. By doing this they looked at a specific	05:26:18
11	case or in order to accomplish it of RA -- of RA	05:26:20
12	codes. And, hence, I would consider that what the	05:26:23
13	main concern at that point was -- was to prove or to	05:26:27
14	establish the validity of this interleaver gain	05:26:33
15	conjecture to various forms of turbo codes.	05:26:39
16	Q. Now, we said earlier that RA codes are a	05:26:44
17	form of turbo; do you recall that testimony?	05:26:47
18	A. That is correct.	05:26:50
19	Q. The Frey irregular turbo codes paper from	05:26:52
20	1999, Exhibit 21, is about making turbo codes	05:26:55
21	irregular, right?	05:27:00
22	A. That is correct.	05:27:00
23	Q. And if I make the repetition of the RA	05:27:03
24	code in Figure 3 irregular, I have an IRA code by	05:27:23
25	definition, right?	05:27:30

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1	MR. GLASS: Objection. Vague.	05:27:31
2	THE WITNESS: So, you know, without giving	05:27:32
3	a legal opinion here, one way of making --	05:27:34
4	accomplishing I -- IRA codes is of -- by definition	05:27:38
5	introducing irregular repeats.	05:27:42
6	BY MR. DOWD:	05:27:45
7	Q. Okay. Now, I take it that if we return to	05:27:46
8	Exhibit 2 you'd never seen -- oh, withdrawn, sorry.	05:27:53
9	I'm sticking with the e-mail exhibit 22.	05:27:57
10	A. Right.	05:28:01
11	Q. So I take it that before you were retained	05:28:01
12	for this case, you had never seen the e-mail that	05:28:04
13	we've marked as Exhibit 22?	05:28:07
14	A. I'm pretty sure no.	05:28:08
15	Q. Okay. So let's see if we can agree on	05:28:10
16	some kind of basic points.	05:28:19
17	We can agree that making an LDPC code	05:28:22
18	irregular improved performance over a regular LDPC	05:28:27
19	code, right?	05:28:32
20	A. We can agree that --	05:28:33
21	MR. GLASS: Objection. Incomplete	05:28:33
22	hypothetical.	05:28:34
23	Go ahead.	05:28:34
24	THE WITNESS: We can agree that in	05:28:35
25	particular situations as there were Luby '97 and	05:28:37

1	Luby '98 and Richardson '99, each of them with very	05:28:42
2	specific restrictions, some form of irregularity	05:28:47
3	improved the performance. The restrictions in the	05:28:49
4	Luby '97 paper were for the binary racial channel	05:28:54
5	for particularly cascaded codes. The restrictions	05:28:58
6	in this Luby '98 paper were that there were a	05:29:02
7	particular way of doing the decoding, which is	05:29:04
8	neither equal to message passing nor equal to the	05:29:07
9	flipping algorithm.	05:29:10
10	And in the case of LDPC codes in the -- in	05:29:11
11	the Richardson '99 paper this was strictly concerned	05:29:16
12	with Gallager type but irregular codes.	05:29:21
13	BY MR. DOWD:	05:29:29
14	Q. So if we go back to Exhibit 17, Luby '98,	05:30:16
15	at page 925, the statement there is:	05:30:23
16	"It is shown that using irregular	05:30:36
17	graphs yields codes with much better	05:30:39
18	performance than regular graphs."	05:30:41
19	Have I read that quote correctly?	05:30:43
20	A. In the context of the quotes, they're	05:30:45
21	consistent.	05:30:49
22	Q. And in Luby '98, they don't say:	05:30:49
23	"It's shown that using irregular	05:30:58
24	graphs yields codes with much better	05:30:59
25	performance than regular graphs only as	05:31:01

1	compared to a flipping algorithm when	05:31:05
2	you're decoding," do they?	05:31:07
3	MR. GLASS: Objection. Vague. Asked and	05:31:10
4	answered.	05:31:11
5	THE WITNESS: That's the only possible	05:31:11
6	conclusion you can draw because that's the only	05:31:13
7	thing they show in the paper.	05:31:16
8	BY MR. DOWD:	05:31:17
9	Q. Well, and maybe that's the only conclusion	05:31:18
10	you can draw, but --	05:31:19
11	A. It's the only conclusion someone, you	05:31:20
12	know, versed in the art could draw.	05:31:22
13	Q. Okay. Sir, in the statement where they	05:31:24
14	explain why it's better performance, there's no	05:31:27
15	mention here on this page of flipping, is there?	05:31:30
16	MR. GLASS: Objection. Asked and answered	05:31:35
17	several times now.	05:31:36
18	Go ahead.	05:31:37
19	THE WITNESS: As I mentioned, it's not	05:31:37
20	customary that every single time when you talk about	05:31:40
21	something that you would repeat all possible	05:31:44
22	restrictions that you're considering.	05:31:46
23	Typically in the abstract you would say,	05:31:47
24	we're considering, you know, a certain type of code.	05:31:50
25	We're considering certain type of decoder. You	05:31:53

1	would not repeat that at every single sentence.	05:31:56
2	BY MR. DOWD:	05:32:00
3	Q. Right. In the abstract, can you point out	05:32:00
4	where it says that this is about a flipping decoder	05:32:03
5	in the abstract?	05:32:06
6	A. Here it's in the abstract, but it's very	05:32:06
7	clearly explained in the paper that that decoding	05:32:06
8	does not send a message passing decoder, but --	05:32:06
9	THE REPORTER: Wait. You're going to have	05:32:06
10	to start that answer over.	05:32:13
11	THE WITNESS: In the paper it is clearly	05:32:13
12	explained that that is not a standard message	05:32:15
13	pattern. We couldn't -- but the Gallager algorithm,	05:32:20
14	as we had discussed beforehand, and it is followed	05:32:23
15	by a flipping algorithm.	05:32:25
16	BY MR. DOWD:	05:32:25
17	Q. Oh, so now it's not important enough to	05:32:27
18	make it into the abstract, but it's still --	05:32:29
19	MR. GLASS: Objection. Argumentative and	05:32:32
20	vague.	05:32:34
21	(Overlapping speakers.)	05:32:34
22	THE REPORTER: Wait. Wait. There was not	05:32:34
23	even a complete question there, and I don't know	05:32:34
24	what your response was, so why don't you guys try	05:32:34
25	again.	05:32:39

1	BY MR. DOWD:	05:32:39
2	Q. Sir, I am correct that the abstract of	05:32:42
3	Luby nineteen ninety -- 1998 does not say anything	05:32:46
4	about flipping decoders, right?	05:32:51
5	MR. GLASS: Objection. Asked and	05:32:58
6	answered.	05:33:02
7	THE WITNESS: It talks about the Gallager	05:33:02
8	algorithm.	05:33:06
9	BY MR. DOWD:	05:33:06
10	Q. Okay.	05:33:06
11	A. Sorry, sorry, let me read this again.	05:33:07
12	It talks about for which our decoding	05:33:12
13	algorithm. It doesn't specify exactly what that is	05:33:15
14	in the abstract because the abstract doesn't specify	05:33:17
15	every single technical detail but it doesn't talk	05:33:20
16	about a message passing algorithm, but it talks	05:33:20
17	about our --	05:33:22
18	THE REPORTER: Wait. Wait. Slow down.	05:33:25
19	"...but it doesn't talk" --	05:33:25
20	Start there.	05:33:26
21	THE WITNESS: It doesn't talk about the	05:33:26
22	message passing algorithm, but it talks about our	05:33:29
23	decoding algorithm.	05:33:33
24	BY MR. DOWD:	05:33:42
25	Q. And if we go to Luby '97, let's turn to	05:33:42

1	Page 94.	05:33:47
2	A. That would be exhibit?	05:33:49
3	MR. GLASS: 9.	05:33:55
4	MR. DOWD: 9.	05:33:58
5	THE WITNESS: 9. Page, sorry?	05:34:01
6	BY MR. DOWD:	05:34:03
7	Q. Last page, 944. Actually, second to the	05:34:03
8	end.	05:34:09
9	A. Yes.	05:34:10
10	Q. The acknowledgement section they describe,	05:34:10
11	quote:	05:34:14
12	"Strong evidence that irregular degree	05:34:14
13	sequences are better than regular degree	05:34:17
14	sequences."	05:34:19
15	Do you see that?	05:34:24
16	A. You're talking about the last paragraph	05:34:24
17	before the acknowledgement?	05:34:33
18	Q. I'm talking about in the acknowledgement	05:34:34
19	they say: There has been, quote, "Strong evidence	05:34:37
20	that irregular degree sequences are better than	05:34:42
21	regular degree sequences", closed quote.	05:34:45
22	Correct?	05:34:47
23	A. That's some acknowledgement. I don't --	05:34:51
24	there's not technical description what "strong"	05:34:53
25	means. It doesn't mean what the decoder is. It	05:34:56

1	doesn't mean what type of irregularity. It doesn't	05:34:59
2	say about, you know, what exactly the channel they	05:35:02
3	are talking about, so it would be impossible to make	05:35:04
4	a qualified statement about that.	05:35:07
5	Q. Y3, it doesn't mention any of those	05:35:09
6	things, right?	05:35:12
7	A. It doesn't mention what they are talking	05:35:17
8	about.	05:35:19
9	O. All it says is: There's strong evidence	05:35:19
10	that, quote, "irregular degree sequences are better	05:35:21
11	than regular degree sequences."	05:35:24
12	A. If they have found strong evidence that	05:35:26
13	proves such a thing, in general, they would have	05:35:29
14	published it at some point.	05:35:32
15	Q. Now, we can agree that making turbo codes	05:35:37
16	irregular improve their performance over regular	05:35:41
17	turbo codes, right?	05:35:44
18	MR. GLASS: Objection. Vague. Incomplete	05:35:46
19	hypothetical.	05:35:47
20	THE WITNESS: Some particular way of	05:35:47
21	improving might help; some other ways might hurt.	05:35:49
22	BY MR. DOWD:	05:35:53
23	Q. Well, if you'd turn in Exhibit 21, the	05:35:54
24	Frey '99 paper, to Page 1826, do you see there are	05:36:05
25	results on that page?	05:36:16

1   A.   18 -- sorry, 18 --   05:36:17

2   Q.   26.   05:36:20

3   A.   Thank you.   05:36:21

4   Q.   Do you see there are results shown on that   05:36:22

5   page, under the heading 5?   05:36:26

6   A.   Figure 4 we're talking about?   05:36:30

7   Q.   I'm saying -- Y3, under the heading 5   05:36:32

8   is -- that's the heading that says: "Results."   05:36:36

9   A.   Oh, I see in that section.   05:36:37

10   Q.   And the second paragraph says: "The   05:36:39

11   irregular turbo code clearly performs better than   05:36:42

12   the regular turbo code for bit error rates," and   05:36:45

13   then it lists them?   05:36:48

14   A.   Yes. So some specific irregular turbo   05:36:49

15   code performs in their experiment better.   05:36:52

16   Q.   Okay. So we can agree that, at least in   05:36:55

17   Luby '99, the regular turbo code outperformed the   05:37:02

18   regular turbo code, right?   05:37:05

19   A.   Luby doesn't talk about turbo codes, I   05:37:07

20   think.   05:37:09

21   Q.   I'm sorry. Let me restate that.   05:37:09

22   We can agree that in Frey '99, the   05:37:11

23   irregular turbo code performed 0.15-dB better than   05:37:15

24   the regular turbo code, right?   05:37:21

25   A.   The particular --   05:37:23

1	MR. GLASS: Objection. Vague.	05:37:23
2	THE WITNESS: The particular irregular	05:37:23
3	turbo code that they're -- that they're referring to	05:37:26
4	has a better performance, yes.	05:37:28
5	BY MR. DOWD:	05:37:30
6	Q. Now, if a person of ordinary skill had	05:37:32
7	read Divsalar and Luby or Divsalar and Richardson or	05:37:36
8	Divsalar and Frey and wanted to make Divsalar's	05:37:40
9	repeat irregular, they could have done so, right?	05:37:44
10	MR. GLASS: Objection. Incomplete	05:37:46
11	hypothetical. Compound.	05:37:47
12	THE WITNESS: In my analysis or my	05:37:49
13	expertise, I was asked in particular to refer to	05:37:53
14	Luby '97, Luby '98 and Richardson '99, and that's	05:37:58
15	what I have done.	05:38:01
16	BY MR. DOWD:	05:38:02
17	Q. Okay. So if a person of skill read	05:38:02
18	Divsalar and Luby '97 and wanted to make Divsalar's	05:38:05
19	repeater irregular they would have known how to do	05:38:11
20	so, right?	05:38:13
21	A. No.	05:38:14
22	Q. Okay. What about Richardson and Divsalar?	05:38:14
23	MR. GLASS: Objection. Vague. Incomplete	05:38:20
24	hypothetical.	05:38:21
25	THE WITNESS: As I have opinioned in my	05:38:21

1	expert report, there were many reasons why the	05:38:26
2	invention of turbo codes was something novel and	05:38:31
3	something surprising.	05:38:36
4	Number one, RA codes -- sorry, irregular	05:38:38
5	RA codes were semi novel and surprising.	05:38:41
6	Number one, at that point in time, RA --	05:38:45
7	RA codes were routinely represented in an entirely	05:38:49
8	different way. So there were no notions of variable	05:38:55
9	nodes or check nodes or anything like that.	05:39:00
10	BY MR. DOWD:	05:39:03
11	Q. I understand. I -- I'm really not asking	05:39:04
12	that question. My question was a very specific	05:39:05
13	question.	05:39:09
14	If a person of skill in '99 read Divsalar,	05:39:09
15	read the Richardson '99 paper and decided that	05:39:15
16	they'd like to make Divsalar's repeater irregular,	05:39:20
17	they would have the technical ability to do that,	05:39:25
18	right?	05:39:25
19	A. I don't know what --	05:39:28
20	MR. GLASS: Objection. Objection. Vague.	05:39:28
21	Incomplete hypothetical.	05:39:30
22	Go ahead.	05:39:31
23	THE WITNESS: I don't know what any of	05:39:32
24	these things mean. What does it mean to say to make	05:39:33
25	a repeater irregular: What notions would that have	05:39:36

1	carried over the Luby paper which talks about	05:39:40
2	specific class of codes which are LDPC codes?	05:39:44
3	So unless you tell me exactly what	05:39:47
4	representation you have in mind and what notions	05:39:49
5	would have carried over, I don't see how to combine	05:39:50
6	those.	05:39:54
7	BY MR. DOWD:	05:39:58
8	Q. Okay. Now, in your report you talk about	05:39:59
9	the prosecution that led to the patents; do you	05:40:19
10	recall that?	05:40:22
11	A. I did a very cursory summary to the best	05:40:22
12	of my knowledge. I'm not an expert. I'm not sure	05:40:25
13	if I got this all right, but I tried to, a little	05:40:29
14	bit, for my benefit, to summarize.	05:40:33
15	Q. Okay. And if we turn, for example, to	05:40:36
16	Paragraph 87, there's a discussion about how the	05:40:43
17	patents claim priority to a provisional application	05:40:46
18	filed on May 18, 2000.	05:40:50
19	Do you see that?	05:40:52
20	A. Right.	05:40:53
21	MR. DOWD: Let's mark as Exhibit 23 a copy	05:40:54
22	of the provisional application.	05:40:56
23	(Urbanke Exhibit 23 was marked for	05:40:59
24	identification and attached to the	05:40:59
25	transcript.)	05:41:11

1	BY MR. DOWD:	05:41:17
2	Q. Do you have Exhibit 23?	05:41:17
3	A. Yes.	05:41:18
4	Q. Do you recognize it?	05:41:19
5	A. You know, some of the figures look	05:41:29
6	familiar, but I must say I have browsed through this	05:41:32
7	very, very quickly, and so, you know, with so many	05:41:35
8	documents to review, I cannot say with certainty	05:41:40
9	what all these documents are.	05:41:43
10	Q. So you can't tell me whether you've read	05:41:45
11	Exhibit 23 before?	05:41:49
12	A. Oh, I've flipped through the history,	05:41:49
13	that's for sure, but, you know, how exactly these	05:41:52
14	pages looked like and what exactly it contained, I	05:41:55
15	don't recall.	05:42:00
16	Q. All right. My question is a simpler one.	05:42:00
17	Is Exhibit 23 the May 18, 2000 provisional	05:42:03
18	application that you are referencing in Paragraph 87	05:42:07
19	of your report?	05:42:10
20	A. I would not know for sure. Clearly, for	05:42:16
21	writing this particular part, I had legal counsel,	05:42:19
22	and to the best of my knowledge, I tried to	05:42:24
23	summarize. But it's possible that I might have	05:42:27
24	gotten some of the facts not exactly correct. I'm	05:42:31
25	not a lawyer.	05:42:33

1	Q. Okay. So this part 6 of your report, the	05:42:35
2	summary of the patents-in-suits, who wrote that, you	05:42:37
3	or the Caltech's lawyers?	05:42:42
4	A. I went over the file history very quickly	05:42:45
5	and had legal assistance trying to sort out and, you	05:42:48
6	know, explain to me what, you know, some very	05:42:53
7	standard notions were. And so with help of legal	05:42:56
8	counsel, this was written.	05:43:01
9	Q. So let me see if I understand.	05:43:03
10	You -- you had explained to you what	05:43:07
11	happened in the file histories of the four	05:43:10
12	patents-in-suits; is that correct?	05:43:14
13	MR. GLASS: Objection. Mischaracterizes	05:43:16
14	the testimony.	05:43:16
15	THE WITNESS: No. I simply had a lot of	05:43:18
16	questions. I ask many of the questions. I got some	05:43:19
17	explanations. Whether or not indeed I fully	05:43:22
18	understood these, is not clear to me. I'm not a	05:43:25
19	lawyer.	05:43:28
20	BY MR. DOWD:	05:43:28
21	Q. Okay.	05:43:28
22	A. That's not my main expertise.	05:43:29
23	Q. And in terms of paragraphs 85 through 119	05:43:31
24	of this, where this section appears, who actually	05:43:39
25	typed this up; did you type this up?	05:43:42

1   A.   Many of these things might not have been   05:43:44

2   that I typed up, but were in discussions.   05:43:47

3   Q.   Okay.   05:43:50

4   A.   I don't recall exactly which parts exactly   05:43:51

5   I typed up, but I clearly had legal counsel.   05:43:53

6   Q.   Okay. So let's return to Exhibit 23, the   05:43:58

7   provisional application. And I'd like you to take a   05:44:02

8   moment and just look through the -- the slide deck   05:44:05

9   that is attached, which begins on Caltech Page 6584   05:44:10

10   and runs through 6616, and just let me know when   05:44:14

11   you're done.   05:44:18

12   A.   What was the last page, 661 -- I don't   05:46:10

13   remember.   05:46:13

14   Q.   It's the last page of the document, so   05:46:13

15   just to the last slide there on Page 6616.   05:46:15

16   A.   So there's several slide decks; is that   05:49:13

17   correct?   05:49:18

18   Q.   There should be two. Just let me know   05:49:18

19   when you've gotten to the end.   05:49:20

20   A.   I've reached the end.   05:51:39

21   Q.   Okay. Can you tell me whether the   05:51:40

22   provisional application discusses indexing memory   05:51:43

23   locations?   05:51:46

24   A.   This is about 60 pages.   05:51:48

25   MR. GLASS: Objection. Objection.   05:51:51

1	Outside the scope.	05:51:52
2	THE WITNESS: I don't know exactly even	05:51:53
3	what the definition of -- of the term that they have	05:51:55
4	used would be. It would be impossible for me now to	05:51:58
5	tell.	05:52:02
6	BY MR. DOWD:	05:52:02
7	Q. Okay. So in your review sitting here now,	05:52:02
8	did you see in anything that discussed memory	05:52:05
9	locations?	05:52:07
10	MR. GLASS: Same objection. Outside the	05:52:08
11	scope.	05:52:09
12	THE WITNESS: These are slides. Many of	05:52:09
13	the things, you know, might not be in there, might	05:52:11
14	be in there. I don't know exactly what the	05:52:14
15	particular term means in the realm that you are	05:52:16
16	talking about.	05:52:18
17	BY MR. DOWD:	05:52:19
18	Q. Okay.	05:52:19
19	A. I have no idea.	05:52:20
20	Q. I'm just asking, you just read through the	05:52:20
21	slides; we took several minutes to do it. Can you	05:52:23
22	point me to any place that discusses an indexed	05:52:28
23	memory location?	05:52:31
24	MR. GLASS: Same objection. Outside the	05:52:32
25	scope --	05:52:32

1	BY MR. DOWD:	05:52:32
2	Q. "Yes" or "no"?	05:52:34
3	MR. GLASS: -- of the expert report.	05:52:34
4	THE WITNESS: I don't even know what the	05:52:35
5	term "index memory location" means for you.	05:52:37
6	BY MR. DOWD:	05:52:37
7	Q. Have you heard the term "index memory	05:52:40
8	location"?	05:52:44
9	A. That means many things to different	05:52:44
10	people.	05:52:44
11	Q. Does it have meaning to you?	05:52:45
12	A. Potentially, but it's not something that I	05:52:45
13	have thought about.	05:52:48
14	Q. What does "index memory location" mean to	05:52:48
15	you?	05:52:51
16	A. I don't know in this particular thing. I	05:52:51
17	have not been asked to opinion on that. It's not my	05:52:53
18	realm of expertise.	05:52:56
19	Q. And am I correct that in reviewing the	05:52:56
20	slides just now you didn't see anything about index	05:52:58
21	memory locations?	05:53:03
22	MR. GLASS: Objection. Outside the scope	05:53:05
23	of --	05:53:06
24	(Overlapping speakers.)	05:53:06
25	THE REPORTER: Wait.	05:53:06

1	MR. GLASS: -- the expert report. Go	05:53:07
2	ahead.	05:53:07
3	THE WITNESS: I didn't look for	05:53:07
4	any particular instance of that. I wasn't even	05:53:12
5	aware of that term --	05:53:12
6	THE REPORTER: Repeat your answer and slow	05:53:12
7	down.	05:53:13
8	THE WITNESS: I was not in particular	05:53:13
9	aware of the term until you told me. I think that	05:53:15
10	would be a particular term to be looking out for.	05:53:19
11	BY MR. DOWD:	05:53:21
12	Q. Okay. Take a minute and just tell me, is	05:53:21
13	there any discussion in here of an index memory	05:53:25
14	location?	05:53:28
15	MR. GLASS: Same objection. Outside the	05:53:28
16	scope.	05:53:29
17	THE WITNESS: Can you give me a definition	05:53:29
18	of what that means.	05:53:30
19	BY MR. DOWD:	05:53:32
20	Q. You -- your understanding, as the person	05:53:32
21	of skill in this art, is better than mine; so using	05:53:35
22	whatever understanding of that term you have.	05:53:38
23	A. I don't have any particular --	05:53:40
24	MR. GLASS: And objection. Calls --	05:53:40
25	THE WITNESS: -- understanding.	05:53:41

1	MR. GLASS: And objection. Calls for a	05:53:41
2	legal conclusion.	05:53:43
3	BY MR. DOWD:	05:53:43
4	Q. You don't know what a memory location is?	05:53:44
5	A. I have some understanding what a memory	05:53:46
6	location might be. Whether or not that has any	05:53:48
7	legal bearing or any opinion on what a memory	05:53:51
8	location means in that case, I have no idea.	05:53:54
9	Q. What is your understanding of what a	05:53:56
10	memory location is?	05:53:58
11	A. It might simply be a place in memory,	05:53:59
12	perhaps physical, perhaps abstract.	05:54:03
13	Q. Do you know what an index is?	05:54:06
14	A. I know what an index could be.	05:54:09
15	Q. Do you know -- what is your understanding	05:54:12
16	of an index with respect to memory?	05:54:13
17	A. I don't know. An index could be	05:54:21
18	important, so perhaps we're talking about important.	05:54:22
19	I have no idea.	05:54:25
20	Q. Okay. So with that understanding of what	05:54:26
21	a memory is and what an index is, do you see any	05:54:27
22	discussion of a memory location or an index in the	05:54:31
23	provisional application?	05:54:40
24	MR. GLASS: Objection. Outside the scope	05:54:40
25	of the expert report.	05:54:41

1   THE WITNESS: This is about 50 pages. If   05:54:42

2   that's a question, I would take, you know, quite a   05:54:44

3   long of time to look at that in detail. Now within   05:54:47

4   a few minutes, it would be impossible to answer that 05:54:50

5   question.   05:54:53

6   BY MR. DOWD: 05:54:53

7   Q.   Well, take a few minutes and just if you   05:54:53

8   could see --   05:54:56

9   (Overlapping speakers.)

10   THE REPORTER: Wait. Wait. Wait. You

11 cannot interrupt him, please.

12   THE WITNESS: Sorry.

13   THE REPORTER: Can I get a clean question,

14 please.

15   MR. DOWD: Sure.

16 Q.   I'd like you to take a few minutes, go   05:55:04

17 back through the slides and tell me if you can   05:55:06

18 identify anything in there that is discussing memory 05:55:09

19 locations or indexing.   05:55:12

20   MR. GLASS: Same objection. Outside the   05:55:13

21 scope of the expert report.   05:55:15

22   THE WITNESS: You're asking right now to   05:55:16

23 do work that typically an expert would take many   05:55:19

24 hours or perhaps days to do within a few seconds or   05:55:21

25 a few minutes on the fly. That's not --   05:55:25

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1	BY MR. DOWD:	05:55:27
2	Q. Well --	05:55:27
3	A. -- a reasonable request.	05:55:26
4	Q. -- whether it's reasonable or not, please	05:55:28
5	do so.	05:55:30
6	MR. GLASS: Same objection. Outside --	05:55:30
7	outside the scope of the expert report.	05:55:32
8	THE WITNESS: I would not even know	05:55:33
9	exactly how I would look for whatever you want me --	05:55:34
10	I don't know exactly the definition you have in	05:55:37
11	mind. I would have no idea how to get started with	05:55:39
12	this task.	05:55:42
13	MR. GLASS: Objection. Calls for a legal	05:55:42
14	analysis.	05:55:44
15	BY MR. DOWD:	05:55:44
16	Q. So if all I ask you is, can you identify	05:55:44
17	for me a set of memory locations or a corresponding	05:55:48
18	index in a provisional patent application, you would	05:55:53
19	have no ability to understand what you're supposed	05:55:57
20	to look for?	05:55:59
21	MR. GLASS: Mischaracterizes the	05:56:00
22	testimony. Outside the scope.	05:56:01
23	BY MR. DOWD:	05:56:01
24	Q. Is that correct?	05:56:04
25	MR. GLASS: Calls for a legal analysis.	05:56:04

1	Go ahead.	05:56:06
2	THE WITNESS: I would need to know exactly	05:56:06
3	what you have been looking for. I would then take a	05:56:08
4	considerable amount of time to ponder that question.	05:56:11
5	I would have to look at these documents in detail,	05:56:14
6	and after a considerable amount of time, which might	05:56:17
7	be hours, which might be days, I might be able to	05:56:19
8	perform an opinion. But it's not something that	05:56:22
9	can -- that can be done within a certain amount of	05:56:24
10	minutes.	05:56:27
11	BY MR. DOWD:	05:56:28
12	Q. So I take it, sitting here right now, you	05:56:28
13	can't tell me one way or the other whether a memory	05:56:31
14	location or a corresponding index is anywhere	05:56:36
15	disclosed in this Exhibit 23?	05:56:40
16	MR. GLASS: Same objections. And	05:56:42
17	mischaracterizes the testimony.	05:56:43
18	THE WITNESS: Without a detailed analysis,	05:56:45
19	this would be impossible to do.	05:56:50
20	MR. DOWD: Let's mark as Exhibit 24 a copy	05:57:20
21	of a document that bears Bates number HUGHES513989	05:57:22
22	through 514001.	05:57:27
23	(Urbanke Exhibit 24 was marked for	05:57:37
24	identification and attached to the	05:57:37
25	transcript.)	05:57:38

1	BY MR. DOWD:	05:57:38
2	Q. Do you have Exhibit 24?	05:57:47
3	A. Yes.	05:57:48
4	Q. And if you would, also take out Exhibit 4,	05:57:50
5	the materials considered page.	05:58:01
6	Do you see on your materials considered	05:58:22
7	there is a reference to Exhibit 24?	05:58:24
8	A. It refers to the fourth item, I believe.	05:58:26
9	Q. Right. But in the body of your report,	05:58:55
10	you did not provide a substantive opinion about	05:58:57
11	Exhibit 24, correct?	05:59:01
12	A. No.	05:59:02
13	Q. You agree with me?	05:59:02
14	A. Yes, that's correct.	05:59:04
15	Q. Okay.	05:59:07
16	MR. DOWD: Let's mark as Exhibit 25 a copy	05:59:15
17	of United States Patent Number 6,081,909, Luby et	05:59:18
18	al.	05:59:37
19	(Urbanke Exhibit 25 was marked for	05:59:37
20	identification and attached to the	05:59:37
21	transcript.)	05:59:38
22	BY MR. DOWD:	05:59:38
23	Q. Do you have Exhibit 25?	05:59:38
24	A. Yes.	05:59:39
25	Q. Have you seen Exhibit 25 before?	05:59:39

1	A. I don't believe so. I'm not 100 percent	05:59:44
2	sure.	05:59:47
3	Q. Okay. Am I correct that you have provided	05:59:48
4	no opinion about Exhibit 25, the Luby '909 patent --	05:59:51
5	A. I don't --	05:59:51
6	Q. -- in your expert report?	05:59:58
7	A. I don't believe I have.	05:59:59
8	Q. Okay.	06:00:01
9	MR. DOWD: Why don't we take a short	06:00:04
10	break. I'm out of exhibit stickers.	06:00:06
11	THE VIDEOGRAPHER: Going off the record.	06:00:09
12	The time is 6:00 p.m.	06:00:10
13	(Recess taken at 6:00 p.m.)	06:00:13
14	THE VIDEOGRAPHER: We are back on the	06:11:08
15	record at 6:11 p.m.	06:11:09
16	MR. DOWD: Sir, during the break I marked	06:11:11
17	as Exhibit 26 a copy of U.S. Patent 4623999.	06:11:13
18	(Urbanke Exhibit 26 was marked for	06:11:21
19	identification and attached to the	06:11:21
20	transcript.)	06:11:21
21	BY MR. DOWD:	06:11:21
22	Q. Do you have that?	06:11:21
23	A. Yes, I do.	06:11:22
24	Q. And if we look at Exhibit 4, your list of	06:11:22
25	materials considered, the '999 patent is listed on	06:11:25

1	the second page, right?	06:11:33
2	A. Yes.	06:11:34
3	Q. But in your -- the body of your expert	06:11:34
4	report, you've provided no opinion about the '999	06:11:38
5	patent, correct?	06:11:43
6	A. That is correct.	06:11:43
7	MR. DOWD: Let's mark as Exhibit 27 a copy	06:11:53
8	of the MacKay et al., paper, "Comparison of	06:11:55
9	Constructions of Irregular Gallager Codes" from	06:12:00
10	1999. It bears production HUGHES1760 through 1765.	06:12:05
11	(Urbanke Exhibit 27 was marked for	06:12:18
12	identification and attached to the	06:12:18
13	transcript.)	06:12:19
14	BY MR. DOWD:	06:12:19
15	Q. Do you have Exhibit 27?	06:12:24
16	A. That is correct.	06:12:25
17	Q. If you look at Exhibit 4, your list of	06:12:26
18	materials considered, the MacKay paper we've marked	06:12:29
19	as Exhibit 27 is listed on the first page of your	06:12:33
20	materials considered, right?	06:12:38
21	A. That is correct.	06:12:39
22	Q. But in the body of your report, you do not	06:12:40
23	provide any substantive opinion about the MacKay	06:12:44
24	paper that we've marked as Exhibit 27?	06:12:48
25	A. That is correct.	06:12:50

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1	Q. Okay.	06:12:51
2	MR. DOWD: Let's mark as Exhibit 28 a copy	06:12:59
3	of the paper by Ping, et al., titled:	06:13:03
4	"Low-Density Parity Check Codes With	06:13:07
5	Semi-Random Parity Check Matrix."	06:13:13
6	(Urbanke Exhibit 28 was marked for	06:13:16
7	identification and attached to the	06:13:16
8	transcript.)	06:13:16
9	BY MR. DOWD:	06:13:16
10	Q. Do you have a copy of Exhibit 28?	06:13:23
11	A. Yes.	06:13:25
12	Q. Exhibit 28 is the Ping paper that's listed	06:13:26
13	on the first page of Exhibit 4, your list of	06:13:31
14	materials considered, right?	06:13:34
15	A. That is correct.	06:13:35
16	Q. But in the body of your expert report, you	06:13:36
17	do not provide an opinion about the Ping paper,	06:13:39
18	Exhibit 28, correct?	06:13:44
19	A. That is correct.	06:13:45
20	Q. Okay. I apologize if I already asked	06:13:46
21	this, but if we go back to Exhibit 16, the RA.c	06:14:19
22	code.	06:14:25
23	A. I have it in front of me.	06:14:49
24	Q. Am I correct that you provide no opinion	06:14:51
25	about the RA.c code that we've marked as Exhibit 16	06:14:53

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1	in the body of your report?	06:14:57
2	A. That is correct.	06:14:58
3	Q. Okay. Again, I apologize if we already	06:15:00
4	covered this, but you've not offered an opinion	06:15:39
5	comparing any specific prior art reference to any	06:15:42
6	specific claim limitation in your report, correct?	06:15:45
7	A. Any specific -- could you just repeat one	06:15:50
8	more time so just that I can parse the sentence	06:15:52
9	exactly?	06:15:56
10	Q. Yes. You have not offered an opinion	06:15:57
11	comparing any specific prior art reference to any	06:16:00
12	specific claim in any of the patents that are at	06:16:04
13	issue?	06:16:07
14	A. That is correct.	06:16:08
15	Q. And, therefore, you've also not provided	06:16:09
16	an opinion comparing any combination of prior art	06:16:11
17	references to any specific claim at issue in the	06:16:14
18	case?	06:16:17
19	A. That is correct.	06:16:17
20	Q. Okay. With respect to the IRA codes	06:16:23
21	discussed in your paper -- or discussed in your	06:16:33
22	report, we looked before at Paragraph 82 where you	06:16:36
23	cite the Jin et al., IRA codes paper; do you recall	06:16:53
24	that?	06:17:01
25	A. Paragraph 82?	06:17:01

1	Q.	Uh-huh.	06:17:01
2	A.	Yes.	06:17:10
3	Q.	And that's also discussed in Paragraph 84,	06:17:12
4	right? That's that same --		06:17:23
5	A.	You mean the particular reference or the	06:17:24
6	notion of IRA codes?		06:17:26
7	Q.	The particular reference there as to the	06:17:28
8	IRA codes paper by Jin et al., what we've marked as		06:17:30
9	Exhibit 5.		06:17:55
10	A.	This is Exhibit 5, you say?	06:17:57
11	Q.	Uh-huh.	06:18:03
12	A.	Yes, it refers to the work by this group	06:18:07
13	of people relating to irregular repeat-accumulate		06:18:11
14	codes.		06:18:16
15	Q.	But you testified earlier that the IRA	06:18:16
16	codes that you're discussing in your report are not		06:18:20
17	the specific IRA codes of that paper, Exhibit 5,		06:18:22
18	right?		06:18:28
19	A.	Can you please repeat? I -- I -- I	06:18:28
20	discussed that the IRA codes discussed in my report		06:18:30
21	are...?		06:18:35
22	Q.	Are not the specific IRA code of the Jin	06:18:36
23	et al., paper that we marked as Exhibit 5, right?		06:18:40
24	A.	I believe I discussed that I didn't give	06:18:43
25	an explicit reference in the sense of, you know,		06:18:45

1	referring to one of the specific references, but	06:18:50
2	only stated, I guess, I believe here the term	06:18:53
3	Dr. McEliece in lieu of that specific reference.	06:18:57
4	Q. Can you point me to anywhere in your	06:19:01
5	report where you identify what the exact structure	06:19:04
6	is of the IRA codes that you are comparing Luby '97,	06:19:07
7	Luby '98, or Richardson '99 to?	06:19:14
8	A. Are we talking now in reference to the RA	06:19:16
9	codes or the result of the -- result of the	06:20:16
10	invention which led to IRA codes?	06:20:18
11	Q. What I'm asking you to do is point me in	06:20:21
12	your report to the paragraph where you identify the	06:20:25
13	exact structure of the IRA code to which you are	06:20:29
14	comparing Luby '97, Luby '98, and Richardson '99.	06:20:33
15	A. I believe a better characterization of	06:20:41
16	comparing these codes is my characterization of	06:20:52
17	claiming that, from the RA description of the codes,	06:20:57
18	it would have not been obvious to a person of	06:21:02
19	ordinary skills at how to arrive at an irregular	06:21:08
20	version.	06:21:11
21	Q. Well, I'm actually asking a different	06:21:11
22	question.	06:21:14
23	So, for example, if you'd turn to	06:21:23
24	Page 28 --	06:21:47
25	A. Yes.	06:21:48

1	Q. -- do you see there's a heading there that	06:21:48
2	says:	06:21:51
3	"Comparison of IRA Codes and Codes	06:21:51
4	Discussed in Dr. Frye's report"?	06:21:54
5	That's your heading number eight?	06:21:56
6	A. Right. That's correct.	06:22:00
7	Q. And so what I'd like to see is, can you	06:22:01
8	point me in your report to where it is you defined	06:22:05
9	the exact structure of the IRA code that you are	06:22:07
10	comparing against Luby '97, Luby '98, or Luby	06:22:11
11	ninety -- or Richardson '99?	06:22:17
12	A. Right. One such place would be Figure 1	06:22:17
13	on page -- or figure I on Page 30.	06:22:20
14	THE REPORTER: 30?	06:22:28
15	THE WITNESS: 30.	06:22:28
16	BY MR. DOWD:	06:22:30
17	Q. If we look at Figure 3 on the right-hand	06:23:22
18	side on Page 3?	06:23:27
19	A. Figure 3, yes.	06:23:28
20	Q. Uh-huh. Now, it's possible to implement	06:23:30
21	the code of Figure 3 in more than one way, right?	06:23:35
22	A. You mean mapping it into hardware, into	06:23:42
23	software, a mathematical description; what exactly	06:23:46
24	are you referring to?	06:23:50
25	Q. I mean that any of the above. You can	06:23:52

1	implement it in hardware in more than one way; you	06:23:58
2	can implement the relationships of variable nodes to	06:24:02
3	check nodes in more than one way, correct?	06:24:06
4	A. There are several ways of representing	06:24:08
5	such code, yes.	06:24:10
6	Q. Right. Now, Figure 3 does not require any	06:24:12
7	specific performance against the Shannon limit,	06:24:24
8	correct?	06:24:27
9	MR. GLASS: Objection. Vague. Incomplete	06:24:27
10	hypothetical.	06:24:29
11	THE WITNESS: Figure 3 is simply a	06:24:29
12	representation of the code itself. It doesn't	06:24:34
13	contain further descriptions.	06:24:37
14	BY MR. DOWD:	06:24:41
15	Q. So you could implement Figure 3 in a way	06:24:44
16	that was closer to the Shannon limit and you could	06:24:46
17	implement Figure 3 in a way that is further away,	06:24:48
18	correct?	06:24:52
19	MR. GLASS: Objection. Vague. Incomplete	06:24:52
20	hypothetical.	06:24:54
21	THE WITNESS: Figure 3's an abstraction,	06:24:54
22	so it doesn't say exactly what that code is. So in	06:24:58
23	my opinion, that's not a question of implementation;	06:25:03
24	it's a question of what exact code do we mean by	06:25:05
25	this figure.	06:25:08

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1	BY MR. DOWD:	06:25:11
2	Q. So let me ask you that question.	06:25:11
3	Can you tell me what the exact code	06:25:13
4	structure is of Figure 3?	06:25:15
5	A. I take it to be a code structure as	06:25:16
6	described by the set of authors in which this degree	06:25:20
7	distribution is chosen to be a good code.	06:25:25
8	Q. So a -- withdrawn.	06:25:31
9	Does Figure 3 require any particular code	06:25:36
10	complexity?	06:25:45
11	MR. GLASS: Objection. Vague. Lacks --	06:25:47
12	vague.	06:25:52
13	THE WITNESS: Require in the sense of that	06:25:52
14	a natural implementation would require that or that	06:25:59
15	it can only be done if it requires that?	06:26:02
16	BY MR. DOWD:	06:26:05
17	Q. The latter.	06:26:05
18	A. One might be able to take any code and	06:26:11
19	make it very complicated and have the complexity	06:26:14
20	that's potentially much worse than what they're, you	06:26:18
21	know, an intended or reasonable implementation might	06:26:22
22	have.	06:26:25
23	Q. And that would still be an IRA code,	06:26:25
24	right?	06:26:29
25	A. I -- you know, whether or not that would	06:26:29

1	be considered an IRA code or not is a matter of	06:26:33
2	definition.	06:26:35
3	Q. Well, you could implement Figure 3 in a	06:26:36
4	very, very complex way; am I correct?	06:26:39
5	MR. GLASS: Objection. Vague.	06:26:42
6	THE WITNESS: You know, if you define to	06:26:44
7	me what "complex" means.	06:26:46
8	BY MR. DOWD:	06:26:48
9	Q. Well, in your report you describe more	06:26:51
10	complex codes and less complex codes, right?	06:26:55
11	A. So in my report, I state that RA codes are	06:26:59
12	linear time encodable, linear time decodable and are	06:27:03
13	efficient codes. So that means that these codes are	06:27:09
14	actually efficient in the implementation.	06:27:14
15	Q. Now, let's turn to Subpart B where you	06:27:52
16	discuss Luby '98, and specifically on Page 31,	06:27:57
17	Section 2 where you say:	06:28:02
18	"Luby '98 cannot be combined with RA	06:28:04
19	codes or turbo codes to arrive at IRA	06:28:06
20	codes."	06:28:10
21	Do you see that there?	06:28:10
22	A. Yes.	06:28:11
23	Q. And is there an identification of the	06:28:11
24	specific IRA codes that you're using for this	06:28:14
25	discussion?	06:28:17

1	A. I don't believe that I have repeated the	06:28:18
2	plot that you can see in Figure I.	06:28:29
3	THE REPORTER: Figure?	06:28:34
4	THE WITNESS: Figure I.	06:28:34
5	BY MR. DOWD:	06:28:36
6	Q. Okay. But did you have in mind the same	06:28:36
7	IRA codes?	06:28:41
8	A. Yes.	06:28:41
9	Q. And is the same true for your discussion	06:28:41
10	of Richardson '99?	06:28:44
11	A. Yes.	06:28:46
12	Q. Now, let's turn back to Page 15 in	06:28:48
13	Paragraph 68. Actually, we should start on	06:29:43
14	Paragraph 67. You say:	06:29:51
15	"Researchers in the coding community	06:29:53
16	have tried many types of changes,	06:29:54
17	including different types of irregularity	06:29:57
18	throughout the years."	06:29:59
19	Right?	06:30:00
20	A. Yes.	06:30:01
21	Q. And so it's correct that in the 1998/1999	06:30:03
22	period that researchers tried many different types	06:30:13
23	of changes to codes, right?	06:30:16
24	A. Yes.	06:30:19
25	Q. And one of the things that a researcher	06:30:19

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1	could try is irregular -- irregularity, right?	06:30:22
2	A. All of these forms that are listed in 68	06:30:26
3	are some form of irregularity, yes.	06:30:30
4	Q. And so what you've identified here are	06:30:36
5	different ways that researchers working on coding	06:30:40
6	may have tried to improve the codes, right?	06:30:46
7	MR. GLASS: Objection. Vague. Incomplete	06:30:52
8	hypothetical.	06:30:53
9	THE WITNESS: I describe various ways in	06:30:53
10	which, in some settings, I'm not claiming that for	06:30:58
11	each particular setting everything has been tried,	06:31:02
12	but I claim that some of these settings or in some	06:31:04
13	settings some of these methods that I mention in 68	06:31:08
14	have been tried.	06:31:15
15	BY MR. DOWD:	06:31:15
16	Q. And the goal at this time was to improve	06:31:15
17	the performance of the codes to get it closer to the	06:31:17
18	Shannon limit, right?	06:31:23
19	MR. GLASS: Objection. Vague.	06:31:24
20	THE WITNESS: That was one primary goal.	06:31:24
21	There might have been other goals to achieve;	06:31:26
22	perhaps, for example, getting lower error floor or	06:31:29
23	other objectives that people had in mind.	06:31:33
24	BY MR. DOWD:	06:31:38
25	Q. And so what researchers in the field were	06:31:40

1   doing at this time was trying different ways to   06:31:43

2   change the code so that they could get closer to the   06:31:48

3   Shannon limit, among other things, right?   06:31:53

4   MR. GLASS: Objection. Vague.   06:31:56

5   THE WITNESS: Among other things. Sorry.   06:31:57

6   (Overlapping speakers.)   06:31:59

7   BY MR. DOWD: 06:32:00

8   Q.   And one of the ways that they were trying   06:32:02

9   to change the code to get closer to the Shannon   06:32:08

10   limit was to change the degrees of the variable   06:32:14

11   nodes --   06:32:18

12   MR. GLASS: Same objection.   06:32:18

13   BY MR. DOWD: 06:32:18

14   Q.   -- right?   06:32:18

15   MR. GLASS: Same objection.   06:32:20

16   THE WITNESS: In the setting of cascaded   06:32:20

17   LDPC codes and for the BC and in the setting of as   06:32:23

18   this was done in Luby '97 and in the setting of LDPC   06:32:29

19   codes irregular but using a particular type of   06:32:34

20   decoder, which is not a message passing decoder, and   06:32:38

21   in the setting of standard LDPC codes, that was   06:32:44

22   done, yes.   06:32:47

23   BY MR. DOWD: 06:33:06

24   Q.   Now, is there a difference between an   06:33:07

25   irregular LDPC code and an irregular RA code?   06:33:12

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1	MR. GLASS: Objection. Vague.	06:33:16
2	THE WITNESS: If you could specify to me	06:33:20
3	what do you mean with "a difference," then I can try	06:33:22
4	to answer this question.	06:33:25
5	BY MR. DOWD:	06:33:26
6	Q. Sure. So we've been talking about	06:33:26
7	irregular LDPC codes today, right?	06:33:28
8	A. Right.	06:33:32
9	Q. We've been talking about irregular RA	06:33:32
10	codes today, right?	06:33:36
11	A. Yes.	06:33:36
12	Q. What is the difference between an	06:33:37
13	irregular LDPC code and an RA code?	06:33:40
14	MR. GLASS: Same objection.	06:33:45
15	THE WITNESS: So if I take the standard	06:33:46
16	LDPC code as it was considered prior to the claimed	06:33:48
17	patent date, then they all relate to either the	06:33:53
18	standard bipartite graph version as of Gallager in	06:33:57
19	which there was no additional structure other than	06:34:03
20	the irregularity or they pertain to the particular	06:34:05
21	structure of the cascade construction as in Luby,	06:34:10
22	and all of them pertain to particular decoding	06:34:16
23	algorithms. And IRA code has particular extra	06:34:20
24	structure that makes it suitable, not only to have	06:34:26
25	surprisingly very good performance, but also makes	06:34:31

1	them inherently linear time encodable and decodable.	06:34:34
2	Q. Does an irregular LDPC code repeat	06:34:39
3	information bits a different number of times?	06:34:43
4	MR. GLASS: Objection. Vague.	06:34:46
5	THE WITNESS: In irregular LDPC codes, you	06:34:47
6	have code word bits and these code word bits have or	06:34:52
7	can have different degrees, depending on which class	06:34:55
8	they fall into.	06:34:59
9	BY MR. DOWD:	06:35:01
10	Q. And so my question is, for an irregular	06:35:01
11	LDPC code, does that code repeat bits a different	06:35:07
12	number of times?	06:35:11
13	MR. GLASS: Same objection.	06:35:12
14	THE WITNESS: I don't know what "repeat"	06:35:13
15	in this context would mean.	06:35:15
16	BY MR. DOWD:	06:35:16
17	Q. It means duplicate.	06:35:16
18	MR. GLASS: Same objection.	06:35:18
19	BY MR. DOWD:	06:35:19
20	Q. So with that understanding of repeat, does	06:35:19
21	an irregular LDPC code repeat bits -- input	06:35:22
22	information bits different numbers of times?	06:35:29
23	A. All I see is that the variable nodes that	06:35:29
24	are -- have different degrees, that's what I'm	06:35:31
25	seeing. How this might be described in other	06:35:35

1   language I don't know.   06:35:38

2   Q.   And so if all you know is that you've got 06:35:40

3   variable nodes with different degrees, that's not   06:35:43

4   enough to know whether you're repeating the   06:35:45

5   information bits a different number of times?   06:35:49

6   A.   That's a definition of what repeat means; 06:35:51

7   it's not a definition what -- what an LDPC code   06:35:53

8   means. So that's simply whatever you have as a   06:35:57

9   definition, according to that definition, you might   06:36:00

10   judge.   06:36:03

11   I don't have any preconceived notion of   06:36:03

12   what that definition means, so I cannot answer that   06:36:05

13   question.   06:36:07

14   Q.   Well, my -- what I'm asking you to assume 06:36:08

15   is that repeat means duplicate; can you make that   06:36:11

16   assumption?   06:36:14

17   A.   What does "duplicate" mean?   06:36:14

18   Q.   Whatever it means. Do you have any   06:36:16

19   understanding of --   06:36:16

20   (Overlapping speakers.)   06:36:17

21   THE REPORTER: Wait. Hold on. I cannot   06:36:22

22   take two people at a time.   06:36:22

23   THE WITNESS: I'm sorry. I'm sorry.   06:36:22

24   THE REPORTER: Just stop for a minute.   06:36:22

25   Clean question, please.   06:36:23

1	BY MR. DOWD:	06:36:23
2	Q. Can you tell me one way or the other	06:36:24
3	whether you understand what it means to duplicate a	06:36:27
4	bit?	06:36:29
5	A. Unless you give me a definition, I cannot	06:36:30
6	tell you if that agrees with this definition.	06:36:33
7	Q. So you can't tell me one way or the other	06:36:37
8	whether -- withdrawn.	06:36:42
9	If I tell you that repeating a bit	06:36:52
10	requires making additional copies of that bit, do	06:36:54
11	you understand what I mean?	06:36:57
12	A. "Requires" is a necessary condition. That	06:36:59
13	doesn't mean a sufficient condition, so it doesn't	06:37:02
14	specify what that actually means.	06:37:04
15	Q. So you can't answer my question?	06:37:07
16	A. You haven't given me a definition. I	06:37:09
17	cannot answer to an unspecified question.	06:37:12
18	Q. My -- my assumption that I'm asking you to	06:37:15
19	make is that repeat requires the creation of a new	06:37:20
20	copy of the input bits, okay? Can you make that	06:37:25
21	assumption?	06:37:32
22	A. You're simply replacing one definition	06:37:32
23	with another definition. At the end it's a chain of	06:37:35
24	definitions. Unless you give me one specific	06:37:38
25	definition and a mathematical term, it's not	06:37:40

1   well-defined.   06:37:43

2   Q.   Well, I guess what I'm struggling with is,   06:37:43

3   I've given you what I -- I've given you what the   06:37:47

4   Court has defined "repeat" to mean and you're   06:37:48

5   telling me that you can't answer my question. So...   06:37:50

6   A.   I have not looked at the exact definition   06:37:54

7   as they're defined in the -- in the patents. I   06:37:56

8   don't know exactly what they mean. I have seen   06:37:59

9   certain -- you know, that certain terms were   06:38:03

10 defined, but that is English.   06:38:04

11   I'm a scientist; I'm dealing with   06:38:06

12 equations; I'm dealing with mathematical objects.   06:38:08

13 Mathematical objects are defined from basic   06:38:12

14 parameters that everyone agrees, and based on these   06:38:15

15 parameters, there's a definition. And there's a   06:38:18

16 logical way to get from one definition to another   06:38:20

17 one, either you can or you cannot.   06:38:22

18   Right now we're talking about English.   06:38:24

19 That's a very different realm. I -- it's quite   06:38:26

20 possible that in the realm of law, these things are   06:38:30

21 defined in this way. I'm not familiar with that.   06:38:32

22 But as a scientist I feel uncomfortable to start   06:38:35

23 with a definition that I don't fully understand or   06:38:38

24 that's not fully specified.   06:38:41

25 Q.   So if all I said to you was, I need to   06:38:43

1	know whether or not having different variable nodes	06:38:47
2	with different numbers of edges, different degrees,	06:38:57
3	means that I repeat bits or I don't repeat bits, you	06:39:04
4	couldn't tell me based on that amount of information	06:39:09
5	what the answer is?	06:39:11
6	MR. GLASS: Incomplete hypothetical.	06:39:12
7	THE WITNESS: No.	06:39:13
8	MR. DOWD: Okay. I think I have nothing	06:39:47
9	further. Thank you.	06:39:49
10	THE WITNESS: Thank you.	06:39:50
11	MR. GLASS: Let's just go off the record.	06:39:51
12	Before we close out, let's go off the record for a	06:39:52
13	minute.	06:39:56
14	THE VIDEOGRAPHER: Going off the record.	06:39:57
15	The time is 6:39 p.m.	06:39:58
16	(Recess taken at 6:39 p.m.)	06:40:00
17	THE VIDEOGRAPHER: We are back on the	06:46:17
18	record at 6:46 p.m..	06:46:19
19	MR. GLASS: Great. Thank you. No further	06:46:22
20	questions, and we can close the deposition out.	06:46:24
21	MR. DOWD: Thank you.	06:46:26
22	THE VIDEOGRAPHER: Thank you. This marks	06:46:27
23	the end of the deposition of Dr. Rüdiger Urbanke.	06:46:28
24	We are going off the record at 6:46 p.m.	06:46:31
25	(Off the record at 6:46 p.m.)	

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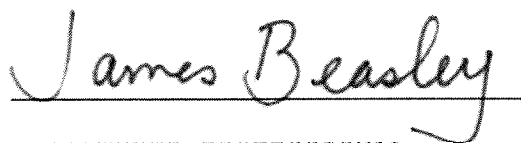
1   CERTIFICATE OF SHORTHAND REPORTER

2   (SAN FRANCISCO, CALIFORNIA)

3

4   I, JAMES BEASLEY, RPR, CA CSR No. 12807,

5   the officer before whom the foregoing deposition was

6   taken, do hereby certify that the foregoing

7   transcript is a true and correct record of the

8   testimony given;

9   that said testimony was taken by me

10 stenographically and thereafter reduced to

11 typewriting under my direction; that reading and

12 signing was not requested;

13   and that I am neither counsel for, related

14 to, nor employed by any of the parties to this case

15 and have no interest, financial or otherwise, in its

16 outcome.

17

18   IN WITNESS WHEREOF, I have hereunto set my

19 hand this 26th day of February, 2015.

20

21

22

23 _James Beasley_

24 REGISTERED PROFESSIONAL

25 REPORTER CA CSR No. 12807

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