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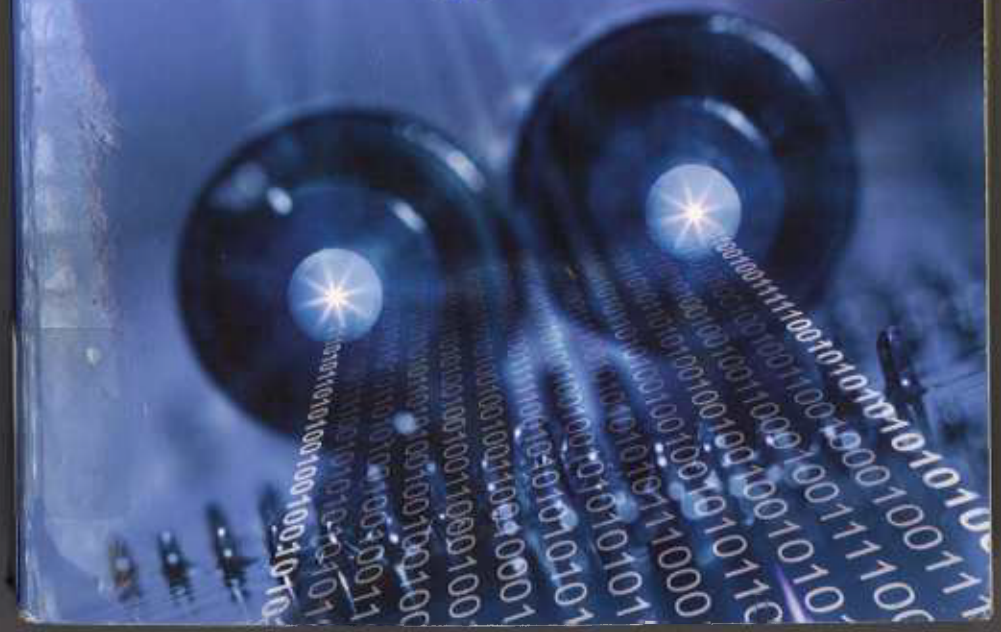

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simple Boolean functions and for flip-flops, as shown in the diagram.

login (logon) The process by which a user identifies herself or himself to a system. The terms are also used as verbs: log in, log on, or *sign on*. A system with many registered users will require each user to log in, and to produce some form of *authentication (such as a password) before allowing the user access to system resources. The login activity will also open an *accounting file for the session.

logistic function A ratio of sums of exponentials widely used in statistical analysis. The logistic function lies in the range (0,1), and its inverse, known as the *logit* of a proportion, is the logarithm of the odds-ratio (*see* ODDS).

logit *See* LOGISTIC FUNCTION.

LOGO A programming language developed for use in teaching young children. LOGO is a simple but powerful language: it incorporates the concept of *procedures, and helps children to think algorithmically. The original version of LOGO incorporated *turtle graphics.

logoff (logout) The process by which a user terminates a session. The terms are also used as verbs: log off, log out, or *sign off*. By logging off, the user ensures that all the system resources that have been used during the session are accounted for, and any temporary files created during the session are deleted.

logon 1. (*or* **log on**) *See* LOGIN.
2. A unit of information, equal to the product of one unit of *bandwidth by one unit of time, in Denis Gabor's physical theory of communication. In contrast, Shannon's mathematical theory of communication uses the concept of *entropy.

logout (*or* **log out**) *See* LOGOFF.

long filename A file name that may have a large number of characters, including spaces, and use upper- and lower-case letters. Long filenames are now supported on most personal-computer operating systems. In earlier systems, the *8.3 system* was common – files had a name of up to eight characters maximum, followed by a dot, followed by a file extension of up to three characters. For example, in this dictionary the file containing this entry is called "OUPCOM0L.XML". On a long-filename system, it could be called "Oxford University Press Computing Dictionary letter L.XML file".

longitudinal redundancy check (LRC) *See* CYCLIC REDUNDANCY CHECK.

lookahead *Short for* carry lookahead.

lookahead unit A unit forming part of an instruction unit pipeline in computers such as *Stretch.

lookup table *See* TABLE LOOKUP.

loop 1. A sequence of instructions that is repeated until a prescribed condition, such as agreement with a data element or completion of a count, is satisfied. *See also* DO LOOP.
2. A configuration of a *local area network that consists of nodes connected serially in a ring topology. *See* RING NETWORK.
3. (local loop) The (twisted pair) connection from a switching exchange to the subscriber terminal.

loop invariant *See* INVARIANT.

lossless coding Coding in which no *information whatsoever is lost during the *encoding (or *decoding) process. Generally, *encryption and *decryption are lossless, as is *channel coding. Strictly, *data compaction is lossless, while *data compression is not, but the latter term is often used for the former. The decoding of (i.e. recovery from) compression and compaction are lossless. But the decoding of a signal received from a *channel is usually lossy (strictly not lossless) by design, since the *noise at least must be lost: the message entering the channel will usually have been prepared so as to permit this loss by the use of an *error-correcting code.

lossless compression Any method of *compression that allows the original data to be recovered from the compressed data. *See also* LOSSLESS CODING.

lossy coding Any form of coding in which *information is or may be lost. *See* LOSSLESS CODING.

lossy compression *Compression of data that approximates the original data so that it is not possible for it to be recovered identically. However a good approximation should always be possible. *See also* LOSSLESS CODING.

Lotus 1-2-3 *Trademark* A *spreadsheet program originally from Lotus Development Corp. (now part of IBM) for personal computers. It also provides simple statistical and database facilities and graph drawing of pie charts, bar charts, and line graphs.

lower bound 1. of a set S on which the *partial ordering $<$ is defined. An element l with the property that $l < s$ for all s in S. Also l is a *greatest lower bound* if, for any other lower bound h, $h < l$.

Since numerical computing demands the truncation of infinite arithmetic to finite arithmetic, the computation of greatest lower bounds of real numbers, indeed of any limit, can only be achieved to a machine tolerance, usually defined to be machine precision: the smallest epsilon eps, such that

$$1.0 + \text{eps} > 1.0$$

in computer arithmetic. *See also* UPPER BOUND.
2. of a matrix or vector. *See* ARRAY.

low-level language A variety of programming language in which the control and data structures directly reflect the underlying machine architecture.

low-level scheduler (dispatcher) *See* SCHEDULER.

low-pass filter A *filtering device that permits only those components in the frequency domain whose frequencies lie below some critical value to pass through with little attenuation, all other components being highly attenuated. *See also* BAND-STOP FILTER, BAND-PASS FILTER, HIGH-PASS FILTER.

lpm *Abbrev. for* lines per minute, one of the terms used to describe the rate of output of line printers.

LPT port The name of a parallel printer port on an IBM PC or compatible. There can be up to three of these ports, called LPT1, LPT2, and LPT3. They are *Centronics interfaces and while designed with printers in mind can be used for other devices such as tape backup systems or network connections.

LQ *Abbrev. for* letter quality. Printed output indistinguishable from that produced by a good electric typewriter. The term is normally applied to dot matrix printers. *See also* NLQ.

LRC *Abbrev. for* longitudinal redundancy check. *See* CYCLIC REDUNDANCY CHECK.

LRM *Abbrev. for* language reference manual. The reference manual for the *Ada language is commonly known as "the LRM".

LR parsing A *bottom-up parsing technique, LR standing for Left-to-right Rightmost derivation sequence. Originally developed by D. E. Knuth, it is the most powerful left-to-right, no backtracking parsing method for *context-free grammars.

An LR parser consists of a pushdown stack, a parsing table, and a driving routine. The driving routine is the same for all grammars. The stack is manipulated by the driving routine using the information contained in the top stack element and the next k symbols in the input stream (called the k *lookahead*); k is an integer ≥ 0, but for most practical purposes $k = 1$. The stack consists of a string

$$s_0 X_0 s_1 X_1 \ldots s_n X_n s_{n+1}$$

where each X_i is a symbol of the input grammar and each s_i is called a *state*.

The parsing table is indexed by pairs (s,a) where s is a state and a is the lookahead. Each entry in the table has two parts: (a) an action, which may be shift, reduce p (for some production p), accept, or error, and (b) a state, called the *goto state*. When the action is shift, the next input symbol and goto state are pushed onto the stack (in that order). When the action is reduce p the top $2l$ elements of the stack will spell the right-hand side of p but with goto states interspersed, where l is the length of this right-hand side. These $2l$ elements are popped from the stack and replaced by the left-hand side of p and the new goto state. This operation corresponds to adding a new node to the *parse tree for the input string. The accept action is only encountered when the start symbol S is the only symbol on the stack (i.e. the stack contains $s_0 S s_1$ for some states s_0 and s_1) and the lookahead is the end-of-input symbol. It signifies that parsing has

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