IEEE Standard Glossary of Data Management Terminology

Circuits and Devices

Communications Technology

Computer

Sponsored by the
Standards Coordinating Committee of the
IEEE Computer Society

Electromagnetics and Radiation

Energy and Power

Industrial Applications

Signals and Applications

Standards Coordinating Committees

IEEE Std 610.5-1990

Published by the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017, USA.

August 3, 1990 *SH13458*

THIS PAGE WAS
BLANK IN THE ORIGINAL

IEEE
Std 610.5-1990

IEEE Standard Glossary of Data Management Terminology

Sponsor

**Standards Coordinating Committee
of the
IEEE Computer Society**

Approved May 31, 1990

IEEE Standards Board

Abstract: IEEE Std 610.5-1990, *IEEE Standard Glossary of Data Management Terminology,* identifies terms currently in use in the field of Data Management. Standard definitions for those terms are established.
Keywords: Data management; glossary; terminology; definitions; dictionary

ISBN 1-55937-039-4

**The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017-2394, U.S.A.**

IEEE Standards documents are developed within the Technical Committees of the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Board. Members of the committees serve voluntarily and without compensation. They are not necessarily members of the Institute. The standards developed within IEEE represent a consensus of the broad expertise on the subject within the Institute as well as those activities outside of IEEE which have expressed an interest in participating in the development of the standard.

Use of an IEEE Standard is wholly voluntary. The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least once every five years for revision or reaffirmation. When a document is more than five years old, and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of all concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason IEEE and the members of its technical committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration.

Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE Standards Board
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
USA

Foreword

(This Foreword is not a part of IEEE Std 610.5-1990, IEEE Standard Glossary of Data Management Terminology.)

The computer field is continuing to expand. New terms are being generated and new meanings are being adopted for existing terms. The IEEE Computer Dictionary project was undertaken to document this vocabulary. Its purpose is to identify terms currently in use in the computer field and to establish standard definitions for these terms. The dictionary is intended to serve as a useful reference for those in the computer field and for those who come into contact with computers either through their work or in their everyday lives.

The completed dictionary will contain terms from thirteen areas: Computer Hardware, Software Engineering, Mathematics of Computing, Theory of Computation, Computer Applications, Artificial Intelligence, Data Management, Image Processing and Pattern Recognition, Modeling and Simulation, Computer Graphics, Computer Networking, Computer Security and Privacy, and Computer Languages. This glossary contains the terms related to Data Management.

Every effort has been made to use definitions from established standards in this dictionary. When existing standards were found to be incomplete, unclear, or inconsistent with other entries in the dictionary, however, new, revised, or composite definitions have been developed.

At the time this glossary was approved, the following people formed the Steering Committee of the Computer Dictionary working group:

Anne K. Geraci, *Leader, Data Management Subgroup*

James Barbera
Freny Katki
John B. Lane
Louise McMonegal
Bennett Meyer
Hugh Porteous
Jane Radatz
Fred Springsteel
Paul C. Wilson
Mary Yee
John Young

Other working group members who contributed to this glossary were as follows:

H. Ronald Berlack
Kathleen Briggs
Susan Chonoles
James Carlestedt
Joel Forman
Shirley A. Gloss-Soler
Jack Goetz
Virl Haas
Gina M. Little
Grace Marumoto
Anita Mires
William Malthouse
Dennis Nickle
Robert Radford
Mary Rasmussen
Roger Rohweder
Leonard Seagren
Sonja Shields
Fred Springsteel
John Sosoka
Anatol Surak
William Sutcliffe
David Usechak
Charlotte Wales
Jack Westbrook
Mary Yee

The sponsor for the Computer Dictionary project is the IEEE Computer Society Standards Coordinating Committee. At the time this standard was approved, the committee had the following membership:

Jim Armstrong
Tim Baker
R. V. Balakrishnan
H. Ronald Berlack
Richard Boberg
John Boebinger
Paul L. Borrill
Terry Bowen
Elliott Brebner
J. Reese Brown, Jr.
Fletcher Buckley
Randy Bush
Clyde Camp
Steve Carter
Ray Chapman
Paul Cook
Bill Corwin
Alan Davis
Steven Deller
Bob Donnan
Paul Eastman
D. Vera Edelstein
Tim Elsmore
Dick Evans
Richard Fairley
Wayne Fischer
David Gelperin
Anne Geraci
Al Gilman
John Graham
Maris Graube
Dave Gustavson
Al Hankinson
Fred Harrison
Chris Haynes
Scott Hopkinson
John Horch
Marlyn Huckeby
Mike Humphrey
John Hyde
James Isaak
Hal Jesperson
David James
Richard Kalish
Hans Karlsson
Freni Katki
Guy Kelley
Kim Kirkpatrick
Stanley Krolikoski
John B. Lane
Ron Leckie
Kevin Lewis
William Lidinsky
Donald C. Loughry
Al Lowenstein
Bill Maciejewski
Roger Martin
Philip Marriott
John McArdle
John McGrory
Louise McMonegal
Sunil Mehta
Paul Menchini
Jerry Mersky
Bennett Meyer
Louis Miller
Mukind Modi
James Mollenauer
Jim Montrose
Jim Mooney
Gary A. Nelson
Keith Patterson
Steven Piatz
Tom Pittman
Robert M. Poston
Shlomo Pri-Tal
Jane Radatz
Larry Saunders
Richard Schmidt
Norman Schneidewind
David Schultz
Karen Sheaffer
Sava Sherr
Fred Springsteel
John Starkweather
Dennis Steinauer
Robert Sulgrove
Oryal Tanir
Michael D. Teener
Donn Terry
Joseph Toy
Leonard Tripp
Rod Tulloss
Jon Turino
Margaret Updike
Eike Waltz
John W. Walz
Camille White-Partain
Cynthia Wright
John Young

Special representatives to the Computer Dictionary working group were as follows:

Frank Jay, *Advisor, IEEE Standards Office*

Rollin Mayer, *Liaison, Accredited Standards Committee X3K5*

The following organizations supported employee participation in the development of this standard:

Burroughs Wellcome Co.
Citicorp
CRS Sirrine
Dutchess Engineering Company
Edinboro University of Pennsylvania
General Data Systems
General Electric
Hughes Aircraft
Library of Congress
Lockheed Saunders
Logicon, Inc.
The MITRE Corporation
Rabbit Software Corp.
RCA
Sci-Tech Knowledge Systems
Siecor Corporation
Technology Applications Group
U.S. Department of HUD
U.S. Naval Facilities
University of Missouri

The following persons were on the balloting committee that approved this document for submission to the IEEE Standards Board:

Michael A. Bame
Jim Barbera
Ronald H. Berlack
Kathleen L. Briggs
Fletcher Buckley
Clyde Camp
Paul D. Cook
Taz Daughtrey
William P. Dupras
Anne K. Geraci
Shirley A. Gloss-Soler
John A. Goetz
John W. Horch
Philip C. Marriott
Jerome W. Mersky
Dennis E. Nickle
Robert Poston
Jane Radatz
Norman Schneidewind
Robert Sulgrove
Oryal Tanir
Jon Turino

When the IEEE Standards Board approved this standard on May 31, 1990, it had the following membership:

Marco W. Migliaro, *Chairman* **Dennis Bodson,** *Past Chairman*

Andrew G. Salem, *Secretary*

Paul L. Borrill
Fletcher J. Buckley
Allen L. Clapp
James M. Daly
Stephen R. Dillon
Donald C. Fleckenstein
Jay Forster*
Thomas L. Hannan
Kenneth D. Hendrix
John W. Horch
Joseph L. Koepfinger*
Michael A. Lawler
Donald J. Loughry
John E. May, Jr.
Lawrence V. McCall
L. Bruce McClung
Donald T. Michael*
Stig Nilsson
Roy T. Oishi
Gary S. Robinson
Terrance R. Whittemore
Donald W. Zipse

*Member Emeritus

Contents

SECTION PAGE

1. Scope 7

2. Dictionary Structure 7

3. References 7

4. Definitions for Data Management Terms 8

FIGURES

Fig 1 Anomaly 10
Fig 2 B-Tree of Order 3 11
Fig 3 B′-Tree of Order 3 11
Fig 4 B*-Tree of Order 3 11
Fig 5 E Is a Child Node of Node D 16
Fig 6 Complete Binary Tree 18
Fig 7 Concatenated Kay 18
Fig 8 Descendant Node 25
Fig 9 Difference 26
Fig 10 Directed Graph 27
Fig 11 Entity/Attribute Matrix 29
Fig 12 First Normal Form 32
Fig 13 Graph 35
Fig 14 Heap 36
Fig 15 Hierarchy 37
Fig 16 Intersection 40
Fig 17 Join 41
Fig 18 Multilist 46
Fig 19 Network 47
Fig 20 Parent Node 50
Fig 21 Product 52
Fig 22 Projection 53
Fig 23 Qualified Name 54
Fig 24 Repeating Field 57
Fig 25 Root Node 58
Fig 26 Second Normal Form 60
Fig 27 Selection 61
Fig 28 Sibling Nodes 62
Fig 29 Graph and Subgraph 65
Fig 30 Table 65
Fig 31 Third Normal Form 66
Fig 32 Tree 67
Fig 33 Trie 68
Fig 34 Union 68

IEEE Standard Glossary of Data Management Terminology

1. Scope

This glossary defines terms in the field of Data Management. Every effort has been made to include all terms in this field. Terms were excluded if they were considered to be parochial to one group or organization, company proprietary or trademarked, multi-word terms whose meaning could be inferred from the definitions of the component words, or terms whose meaning in the computer field could be directly inferred from their standard English meaning.

2. Dictionary Structure

Entries in the dictionary are arranged alphabetically. An entry may consist of a single word, such as "data," or a phrase, such as "least significant character." Phrases are given in their natural order (least significant character) rather than in reversed order (character, least significant).

Blanks are taken into account in alphabetizing. They precede all other characters. Hyphens and slashes are alphabetized as blanks.

If a term has more than one definition, the definitions are numbered. The order of the definitions does not imply preference or frequency of use. In most cases, noun definitions are given first, followed by verb and adjective definitions as applicable. Examples and notes have been added to clarify selected definitions.

The following cross-references are used to show a term's relationship to other terms in the dictionary:

- *Contrast with* refers to a term with an opposite or substantially different meaning.
- *Syn* refers to a synonymous term.
- *See also* refers to a related term.
- *See* refers to a preferred term or to a term where the desired definition can be found.

3. References

In those cases in which a definition is directly quoted from an existing dictionary or glossary, the following references apply:

[610.2] IEEE Std 610.2-1987, *IEEE Standard Glossary of Computer Applications Terminology* (ANSI).[1]

[1012] IEEE Std 1012-1986, *IEEE Standard for Software Verification and Validation Plans* (ANSI).

[1084] IEEE Std 1084-1986, *IEEE Standard Glossary of Mathematics of Computing Terminology* (ANSI).[2]

When the following drafts standards are approved and published they will become part of these references:

[P610.12] IEEE P610.12, Draft Glossary of Software Engineering Terminology.

[ANDIPS] ANSI X3, *American National Dictionary for Information Processing Systems.*[3]

[ANDIPS/ISO] Definitions found in [ANDIPS] above and approved for usage internationally as adopted by the International Organization for Standardization (ISO).

---

[1]IEEE publications are available from the Service Center, the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

[2]This Standard will be renumbered as 610.1 when republished.

[3]This material is reproduced with permission from American National Standards Committee X3 Technical Report, *American National Dictionary for Information Processing Systems,* X3/TR1-82, copyright 1982 by the Computer Business Equipment Manufacturers Association (CBEMA), 311 1st Street NW, Suite 500, Washington, DC 20001. ANSI documents are available from the Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018.

4. Definitions for Data Management Terms

access. (1) The process of obtaining data from or placing data into a storage device. *Syn*: **storage access.** *See also*: **access method; access mode.**
(2) To obtain data from or place data into a storage device as in (1). *See also*: **direct access; indexed access; indexed sequential access; partitioned access; sequential access.**

access method. A method for logically structuring data so that the storage location of any specific data item is well-defined. *See also*: **basic access method; direct access method; queued access method.** *Syn*: **access technique.**

access mode. A technique that is used to access logical records within a file. *See also*: **direct access mode; file access mode; indexed sequential access mode; sequential access mode.**

access path. The manner in which related data items are linked to one another to permit access.

access technique. *See*: **access method.**

access type. *See*: **file access mode.**

accuracy control character. A control character used to indicate whether the data with which it is associated are in error, are to be disregarded, or cannot be represented on a particular device. *Syn*: **error control character.** [ANDIPS][4]

ACK. Abbreviation for **acknowledge character.**

acknowledge character (ACK). (1) A transmission control character transmitted by a station as an affirmative response to the station with which the connection has been set up. [ANDIPS/ISO]
(2) A transmission control character transmitted by a receiver as an affirmative response to a sender. An acknowledge character may also be used as an accuracy control character. *See also*: **negative acknowledge character.** [ANDIPS]

[4]Acronyms in brackets correspond to those of the References in Section 3.

active data dictionary. A data dictionary that ensures its own consistency with a system by limiting the data items that may be used by a process to those that are defined in the data dictionary. *Syn*: **embedded data dictionary.** *Contrast with*: **passive data dictionary.**

active file. (1) A file that is in current use.
(2) A file with an expiration date that has not yet been reached.

actual key. A key that directly expresses the physical location of a logical record on a storage medium.

ad hoc (adhoc). Pertaining to an item such as a computer program or database used for a particular and specific purpose; for example, an ad hoc query. *Note*: Usually the item is used for a relatively short time, then discarded.

ad hoc query. A query that is used for a particular and specific purpose. *Note*: Such a query is usually used once or twice, then discarded.

add. To insert a record into an existing file.

add file. A file containing records that are being added or are to be added to a master file.

add record. A record that is to be added or which has been added to a master file. *Contrast with*: **deletion record.**

address calculation sort. An insertion sort in which each of the items to be sorted is inserted into one of several lists, according to an address calculated from its value, and the resulting lists are then merged. *Syn*: **multiple list insertion sort.**

address table sorting. A sorting technique in which a table of addresses that point to the items to be sorted is manipulated instead of moving the items themselves. *See also*: **key sorting; list sorting.**

Adel'son-Velskii and Landis (AVL) tree. A height-balanced binary tree in which the difference in height of the two subtrees of

any node is at most 1. *Note*: Also referred to as a HB tree; a height-balanced 1-tree.

aggregate. *See*: **data aggregate**.

algebraic coding function. In hashing, a hash function that returns the result of evaluating some polynomial in which selected digits of the original key are used as coefficients. For example, in the function below, the first three digits of the original key are evaluated as a, b, and c, respectively, in the polynomial $a + b\,x + c\,x^2$ with x=14.

Original key	Calculation	Hash value
964721	$9 + 6(14) + 4(14)^2 = 877$	877
864765	$8 + 6(14) + 4(14)^2 = 876$	876

alias. *See*: **alternate name**.

alignment. Pertaining to data that are stored beginning at certain machine-dependent boundaries. Such data is said to be "aligned," otherwise it is said to be "unaligned;" for example, a four-bit data item is aligned if it begins on a full-word boundary of eight-bit words. *Syn*: **boundary alignment**.

alpha. (1) Abbreviation for alphabetic.
(2) * Deprecated abbreviation for **alphanumeric**.

alphabet. An ordered set of all the letters or symbols used in a language, including letters with diacritical signs where appropriate, but not including punctuation marks.

alphabetic. Pertaining to data that consist solely of letters from the same alphabet. For example, (AaBbCcDdEe...) plus the space character. *Syn*: **alpha**. *See also*: **alphanumeric**; **character**.

alphabetic character set. A character set that contains alphabetic characters and that may contain control characters, special characters, and the space character, but not digits.

alphabetic code. A code that uses alphabetic characters to represent data.

alphabetic shift. A control for selecting the alphabetic character set on an keyboard or printer. *Contrast with*: **numeric shift**. *See also*: **shift character**.

alphabetic string. A character string consisting solely of alphabetic characters.

alphameric. Abbreviation for **alphanumeric**.

alphanumeric (alphameric). Pertaining to data that contain the letters of an alphabet (AaBbCcDdEeFfGgHh...), the decimal digits (0123456789), and may contain control characters, special characters and the space character.

alphanumeric character set. A character set that contains alphanumeric characters.

alphanumeric code. A code that uses alphanumeric characters to represent data.

alter. (1) To insert, delete, or modify a data record.
(2) To change a logical relationship or physical structure of a database. *See also*: **modify**.

alternate index. An index (2) that uses alternate keys to reference indexed data. *See also*: **secondary index**.

alternate key. (1) In a relation, a candidate key that is not chosen to be the primary key for that relation.
(2) A secondary key for an indexed sequential file. *See also*: **alternate index**; **prime key**.

alternate name. Any name besides the data element name by which a data item is known. *Note*: Often stored in data dictionaries. *Syn*: **alias**.

ancestor. Relative to a given node x within a tree, any node y for which x is a descendent node of y.

anomaly. In data management, an irregularity that arises when processing an improperly structured database. For example, in order to retrieve all the SUPPLIERS from the following database, one would have to search sequentially through all the PARTS

INVENTORY segments. This is said to be an *anomaly* (see Fig 1).

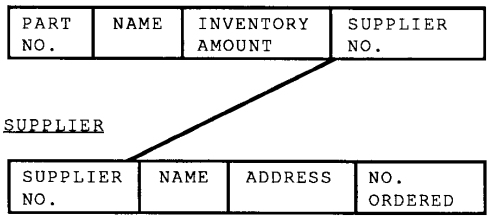

Fig 1
Anomaly

application. The use to which a computer system is put; for example, a payroll application, an airline application, or a network application.

application program. A computer program that is used for a specific application.

application view. *See*: **logical database.**

archival database. A copy of a database saved for later reference or use.

area. (1) A named collection of records within a database. *Note*: May contain occurrences of one or more record types, and a record type may have occurrences in one or more area. *Syn*: **realm.**
(2) In CODASYL, a part of a database that can be opened or closed as a unit. *Note*: This term was used in early CODASYL documents, but is now considered deprecated.

arithmetic. Pertaining to data that has the characteristics of base, scale, mode, and precision. *Note*: Used to represent numbers. See also: **binary picture data; coded arithmetic data; decimal picture data; numeric data.** *Contrast with*: **string.**

array. An *n*-dimensional ordered set of data items identified by a single name and one or more indices, so that each element of the set is individually addressable. *See also*: **linear array.** [P610.12]

association. In data management, a relationship established in a data model to represent a connection between entities that is not reflected solely by the attributes inherent in the entities.

associative lookup. Table lookup performed on a table that is stored in associative memory.

atomic condition. The basic qualification condition in a query, consisting of the name of a data item, a logical operation, and a value; for example, LASTNAME = 'Jones.' *See also*: **item condition; query condition; record condition.**

atomic data element. A data element that cannot be broken into constituent data elements. *Contrast with*: **composite data element.**

attribute. (1) A characteristic of an item; for example, the item's color, size, or type. *See also*: **data attribute.** [P610.12]
(2) In a relation, a named characteristic, property, or description of an entity. *Note*: Also known as data element, data field, data item or column in a table. *See also*: **column.** *Syn*: **data field.**

attribute data element. A data element within a record that represents a property, feature, or characteristic of the subject of that record; for example, the data element "date of birth" in a record containing "name," "address," and "date of birth" of a person. *Contrast with*: **primary data element.**

automated data medium. *See*: **machine-readable medium.**

automatic check. A check that is built into a device in order to verify the accuracy of information transmitted, manipulated, or stored by that device. *Syn*: **built-in check; hardware check.**

AVL tree. Acronym for Adel'son-Velskii and Landis tree. A height-balanced binary tree. *Note*: Also referred to as a HB tree; a height balanced 1-tree.

B-tree (B tree). (1) A height-balanced search tree of order n in which each node contains

keys $\{k_1, k_2, \ldots k_m\}$ in ascending order, where $m <= n - 1$. The i-th subtree of that node contains all the key values falling between k_{i-1} and k_i, with the first subtree containing all key values less than k_1 and the last subtree containing all key values greater than k_m. For example, in the B-tree in Fig 3 below, the lowest notes contain "values less than 10," "11-19," "20–44," "45–59," and "values greater than 60," respectively. *Note*: The height balance of a B-tree is zero. *Syn*: **B-tree index**. *See also*: **B′-tree**; **B*-tree**.

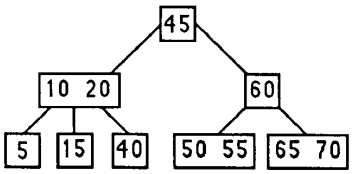

Fig 2
B-Tree of Order 3

(2) A B-tree as in (1) in which every nonterminal node except the root has at least $n/2$ subtrees. *Note*: When a node overflows, it is split into two separate nodes, with the parent node updated accordingly.
* (3) *See:* **binary tree.**
* Deprecated.

B′-tree. A modified B-tree in which identifiers for all nodes are stored in terminal nodes.

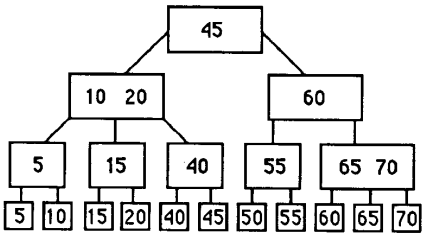

Fig 3
B′-Tree of Order 3

B*-tree. A B-tree in which the root node has between 2 and 2+1 descendants, and each remaining node has between $(2m-1)/3$ and m descendants. That is, two-thirds of the available space in each node is used. *Note*: When a node overflows, keys from that node are moved into one of its sibling nodes if possible; otherwise the node, together with one of its sibling nodes, is split into three nodes.

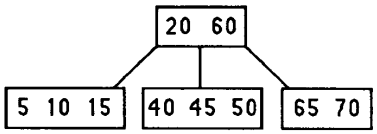

Fig 4
B*-Tree of Order 3

B-tree index. *See*: **B-tree.**

back out. *See*: **rollback.**

backspace character (BS). A format effector character that causes the print or display position to move one position backward along the line without producing the printing or display of any graphic.

backup (back-up). (1) A system, component, file, procedure, or person available to replace or help restore a primary item in the event of a failure or externally-caused disaster. [P610.12]
(2) To create or designate a system, component, file, procedure, or person as in (1). [P610.12]

backward recovery. The reconstruction of a file to a given state by reversing all changes made to the file since it was in that state. *Contrast with*: **forward recovery; inline recovery.** [P610.12]

balanced merge. A merge in which the subsets to be merged are equally distributed among half of the available storage, then the subsets are merged onto the other half of storage. *Contrast with*: **unbalanced merge.**

balanced merge sort. A merge sort in which the sorted subsets created by internal sorts are equally distributed among half of the available storage, the subsets are merged onto the other half of the available storage, and this process is repeated until all the items are in one sorted set. *Contrast with*: **unbalanced merge sort.**

balanced tree. *See*: **height-balanced tree.**

BAM. Acronym for **basic access method.**

base relation. A relation that is not derivable from other base relations in a given database. *Contrast with*: **derived relation.**

basic access method (BAM). An access method in which each input or output statement invokes a corresponding machine operation. For example, when reading a file with 10 records, exactly 10 READ operations will be invoked. *Contrast with*: **direct access method; queued access method.** *See also*: **basic direct access method; basic indexed sequential access method; basic partitioned access method; basic sequential access method.**

basic direct access method (BDAM). A variation on the basic access method that allows direct access to the data.

basic indexed sequential access method (BISAM). A variation on the basic access method that allows indexed sequential access to the data. *See also*: **queued indexed sequential access method.**

basic partitioned access method (BPAM). A variation on the basic access method that allows partitioned access to the data.

basic sequential access method (BSAM). A variation of the basic access method that allows sequential access to the data. *See also*: **indexed sequential access method; queued sequential access method; virtual sequential access method.**

Batcher's parallel sort. A merge sort in which corresponding items in two ordered subsets are simultaneously compared and, if necessary, exchanged; the resulting subsets are divided in half and interleaved with one another, and these steps are repeated until the merge is complete. *Note*: This algorithm is particularly appropriate for parallel processing. *Syn*: **merge exchange sort; odd-even sort.** *See also*: **bitonic sort.**

BCD real data. Acronym for **binary-coded decimal real data.**

BCNF. Acronym for **Boyce/Codd normal form.**

BDAM. Acronym for **basic direct access method.**

BEL. Abbreviation for **bell character.**

bell character (BEL). A control character that is used when there is a need to call for human attention and that may activate an alarm or other attention devices. [ANDIPS/ISO]

binary. (1) Pertaining to a selection in which there are two possible outcomes. [1084]
(2) Pertaining to the numeration system with a radix of two. [1084]

binary chop. * *See*: **binary search.**
* Deprecated.

binary code. A code that uses exactly two distinct characters, usually 0 and 1, to represent data or instructions.

binary coded decimal (BCD) real data. A technique for assigning numeric characters such that each decimal digit is represented by a unique arrangement of binary digits with an implied radix point at a specified position.

decimal	163.3_{10}
BCD real	$0001\ 0110\ 0011\ .\ 0011_2$

binary coded decimal character set. A character set containing all 64 characters that can be represented as permutations of six bits.

binary data. Numeric data used to represent binary digits. *See also*: **binary picture data; fixed-point binary data; packed binary data.**

binary digit (bit). (1) A unit of information that can be represented by either a zero or a one. [P610.12]
(2) An element of storage that can hold a unit of information as in (1). [P610.12]
(3) A numeral used to represent one of the two digits in the binary numeration system; zero (0) or one (1). *See also*: **binary element; byte; word.** [P610.12]

binary digit character. A character within a picture specification that represents a binary digit.

binary element. A data element that can assume either of two possible values or states. *See also*: **binary digit.** [1084]

binary insertion sort. An insertion sort in which each item in the set to be sorted is inserted into its proper position in the sorted set using a binary search algorithm. *Contrast with*: **two-way insertion sort.**

binary picture data. Arithmetic data that is associated with a picture specification that allows binary digit characters, a radix point, exponent characters, and sign characters. *Syn*: **numeric bit data.** *Contrast with*: **decimal picture data.**

binary radix trie search. A radix trie search using a binary trie in which only one bit is considered on each branch. *See also*: **multiway radix trie search.**

binary relation. A relation with two attributes.

binary search. A dichotomizing search in which, at each step of the search, the remaining set of items is partitioned into two equal parts. *Syn*: **binary chop; bisection; logarithmic search.** *Contrast with*: **fibonacci search; interpolation search.** *See also*: **binary search tree; binary tree search.**

binary search tree. A search tree of order 2.

binary tree. A tree in which each nonterminal node has at most two subtrees. *Note*: B tree is sometimes used incorrectly in reference to a binary tree. This usage is considered deprecated. *See also*: **binary search tree; complete binary tree; full binary tree; *n*-ary tree; weight-balanced tree.**

binary tree search. A search in which the items in the set to be searched are placed in a binary tree, and the tree is traversed making key comparisons until the argument is found, or the end of the tree is encountered. *See also*: **binary search; digital tree search.**

BISAM. Acronym for **basic indexed sequential access method.**

bisection. *See*: **binary search.**

bit. Acronym for **binary digit.**

bit string. A sequence of binary digits; for example, the bit string 0101001. *See also*: **character string.**

bitonic merge. *See*: **bitonic sort.**

bitonic sort. A variation on Batcher's parallel sort in which one of the two ordered subsets begins in reverse order and the items to be compared and exchanged are selected from the same subset. *Syn*: **bitonic merge.**

blank character. A graphic representation of the space character. [ANDIPS]

block. (1) A group of contiguous storage locations, computer program statements, records, words, characters, or bits that are treated as a unit. *Syn*: **data block.** [P610.12] (2) To form a group as in (1). *Contrast with*: **deblock.** [P610.12]

block gap. **See*: **interblock gap.**
* Deprecated.

block length. The number of units in a block. *Syn*: **block size.**

block overhead. Any information, besides the actual data, that is stored with a block; for example, the size and location of the records within the block is considered overhead. *See also*: **loading factor.**

block size. *See*: **block length.**

blocked record. A record that is contained in a block that contains at least one other record. *See also*: **spanned record; unblocked record.**

blocking. The process of creating a block from one or more records. [P610.12]

blocking factor. The number of logical records in a block.

bonding. A technique used in database design, in which two or more data items are defined and physically stored together; for example, one might bond data items FIRST-NAME and LAST-NAME.

bottom. (1) In a queue, the position of the item that has been in the queue for the shortest time.
(2) In a stack, the position of the item that has been in the stack for the longest time. *Contrast with*: **top.**

boundary alignment. *See*: **alignment.**

Boyce/Codd Normal form (BCNF). Developed by R. F. Boyce and E. F. Codd, one of the forms used to characterize relations; a relation is said to be in Boyce/Codd Normal form if every determinant in the relation is or contains a candidate key; that is, no attribute is transitively dependent on any key. *Note*: This is an extension of third normal form.

BPAM. Acronym for basic partitioned access method.

branch. In data management, a synonym for subtree.

branch node. *See*: **nonterminal node.**

brother. *See*: **sibling node.**

BS. Acronym for the backspace character.

BSAM. Acronym for basic sequential access method.

bubble sort. An exchange sort in which adjacent pairs of items are compared and exchanged, if necessary, and all passes through the set proceed in the same direction. *Syn*: **exchange selection sort; propagation sort; sifting sort.** *Contrast with*: **cocktail shaker sort.**

bucket. (1) An area of storage that may contain more than one record and that is referenced as a whole by some addressing technique.
(2) In hashing, a section of a hash table that can hold all records with identical hash values.

buffer. (1) A device or storage area used to store data temporarily to compensate for differences in rates of data flow, time of occurrence of events, or amounts of data that can be handled by the devices or processes involved in the transfer or use of the data. *Syn*: **input buffer; input/output area; output buffer.** [P610.12]
(2) To allocate, schedule, or use devices or storage areas as in (1). [P610.12]

buffer pool. A collection of buffers that can be allocated and used as needed.

buffer storage. A storage device that is used as a buffer. *Syn*: **buffer store.**

buffer store. *See*: **buffer storage.**

buffered input. Input that is received using buffers.

built-in check. *See*: **automatic check.**

byte. (1) A group of adjacent binary digits operated upon as a unit and usually shorter than a computer word (frequently connotes a group of 8 bits). [1084]
(2) An element of computer storage that can hold a group of bits as in (1). [P610.12]

calc algorithm. *See*: **hash function.**

calc chain. *See*: **collision chain.**

CAN. Abbreviation for the **cancel character.**

cancel character (CAN). (1) A control character used by some convention to indicate that the data with which it is associated are in error or are to be disregarded. *Syn*: **ignore character.** [ANDIPS/ISO]
(2) An accuracy control character used to indicate that the data with which it is associated are in error or are to be disregarded. [ANDIPS]

candidate key. In a relational data model, any minimal set of attributes within a relation that forms a key that is a determinant of all attributes in the relation. *Note*: In normalization, one of the candidate keys of each relation is chosen as the primary key and the others are known as alternate keys.

See also: **compound key.**

canonical model. A data model that represents the inherent structure of the data, independent of any specific implementations.

canonical synthesis. A technique for generating a canonical model from the relations in a database.

cardinality. (1) The number of elements in a set.
(2) In a relational data model, the number of tuples in a relation.

carriage return character (CR). A format effector that causes the print or display position to move to the first position on the same line. *Syn*: **new-line character.** [ANDIPS/ISO]

cascade merge sort. An unbalanced merge sort in which the distribution of the sorted subsets is based on the cascade numbers. *See also*: **polyphase merge sort.**

catalog (catalogue). (1) A directory of the location of files within a system. *See also*: **file directory.**
(2) The set of all indices used to reference a file, database, or system.
(3) The index to all other indices. *Syn*: **master index.**
(4) To enter information about a file, database, or system as in (1) and (2).

catenate. *See*: **concatenate.**

cell. *See*: **data element; data item.**

chain. (1) *See*: **circularly-linked list.**
(2) **See*: **linked list.**
* Deprecated.

chain field. *See*: **link field.**

chained list. *See*: **linked list.**

chaining. A method for storing records in which each record has a link field that is used to access subsequent records.

chaining search. A search in which each item contains a means for locating the next item to be considered in the search.

character. A letter, digit, or other symbol that is used to represent data. *See also*: **alphabetic; alphanumeric.** [1084]

character code. A code that uses unique numeric values to represent character data; for example, in ASCII the hexadecimal value 40 is used to represent the character "@."

character fill. To insert into a storage medium, as often as necessary, the representation of a specified filler character that does not itself convey data but that may delete unwanted data or initialize storage. *See also*: **zero fill.**

character set. (1) The set of all characters that is defined for a given system. [1084]
(2) A finite set of unique characters upon which agreement has been reached and that is considered complete for some purpose; for example, all the letters, numbers, and symbols used in a language.
(3) A finite set of unique representations called characters, made to denote and distinguish data; for example, the 26 letters of the English alphabet; 0 and 1 of the boolean alphabet; the set of signals in the Morse code alphabet; and the 128 ASCII characters. *See also*: **alphabetic character set; alphanumeric character set; coded character set; numeric character set.**

character string. A sequence of characters; for example, the character string 72ZABC. *See also*: **bit string.**

character string picture data. Picture data that is associated with a picture specification that specifies at least one alphanumeric character.

character variable. A variable that may assume values of any character within some character set.

character-deletion character. A character within a line of terminal input specifying that it and the immediately preceding character are to be removed from the line; for example, if "\" is the character- deletion character in the string "ABD\C," the follow-

ing would appear on the terminal: "ABC." *See also*: **line-deletion character.**

check. To verify the accuracy of data transmitted, manipulated, or stored by any unit or device in a computer. *See also*: **automatic check; check character; check key; consistency check; echo check; sequence check.**

check character. (1) A character used for the purpose of performing a check.
(2) A single character from a check key.

check key. A key that is used for the purpose of performing a check; for example, in the following example the check key is equal to the sum of the first and last digit in field x; this check key could be used to ensure that field x is accurate and complete.

record number	field x	check key
1	0125	5
2	1136	7
3	2228	10

check problem. A test or problem that is chosen to determine whether an operations or computer program is operating properly.

child node. In a tree, a descendant node having a given node as its parent node. *Syn*: **daughter; son.** *Contrast with*: **parent node.** *See also*: **sibling node.**

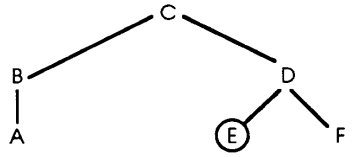

Fig 5
E is a Child Node of Node D

child segment. In a hierarchical database, a segment that has a parent segment and that is dependent on that segment for its existence. *Note*: If the parent segment is deleted, the child segment must be deleted. *Contrast with*: **parent segment.** *See also*: **dependent segment; logical child segment; physical child segment; twin segment.**

circular list. *See*: **circularly-linked list.**

circularly-linked list. A linked list in which the last item contains a pointer to the first item. *Syn*: **chain; circular list; ring.**

coalesce. To combine two or more sets into one set. *See also*: **collate; merge.**

cocktail shaker sort. An exchange sort in which adjacent pairs of items are compared and exchanged, if necessary, and alternate passes through the set proceed in opposite directions. *Contrast with*: **bubble sort.**

CODASYL. Acronym for **Conference on Data Systems Languages.** An organization that establishes standards for database structures.

CODASYL database. A database that adheres to the standards established by the Database Task Group of CODASYL. *Note*: A network database is generally accepted to be synonymous with a CODASYL database.

CODASYL model. A network database model defined by the CODASYL organization. The CODASYL model is based on sets that are used to specify associations between different record types that exist in a database. *Syn*: **flex model.**

CODASYL set. *See:* **set.**

code. (1) A set of rules used to convert data from one form of representation to another. *Syn*: **coding scheme; data code; data element tag.**
(2) Data that have been converted from one form of representation to another, using a set of rules as in (1). *See also*: **code set; coded representation; symbol.** *Syn*: **encoded data.**
(3) Data that have been expressed in symbolic form.
(4) A character or bit pattern that is assigned a particular meaning; for example, a status code.
(5) To convert data from one form of representation to another, using a set of rules as in (1). *See also*: **decode; encode.**
(6) To represent data in symbolic form. [1084]
(7) * *Syn*: **code set.**
* Deprecated.

code converter. A device or system that changes the representation of data from one code to another.

code extension character. Any control character used to indicate that one or more of the succeeding coded representations are to be interpreted according to a different code or according to a different coded character set. [ANDIPS/ISO]

code set. The complete set of coded representations used by a particular code. For example, the set of three-letter codes used to represent airports.

code value. *See*: **coded representation.**

code-decode table. A table that identifies a correspondence between encoded and decoded data items. *Syn*: **encode-decode table; look-up table.**

coded arithmetic data. Data stored in a form that is acceptable for arithmetic calculations without conversion to an intermediate form; for example, data stored in integer form.

coded character set. A set of characters for which coded representations exist. *Syn*: **coded representation; code set.**

coded representation. The result of applying a code to a particular item of data. For example, the designation ORY for Paris International Airport, obtained by applying the international three-letter code for airports. *Syn*: **code value.** *See*: **coded character set.**

coding scheme. *See*: **code (1).**

collate. To arrange items from two or more ordered subsets into one or more other subsets. The resulting subsets will commonly contain at least one item from each of the original subsets and may be ordered in some specified order that is not necessarily the order of any of the original subsets. *See also*: **coalesce; collating sequence (1); merge.** *Contrast with*: **decollate.**

collating sequence. (1) A sequence assigned to a set of items such that any two sets that are in that assigned order can be collated.

(2) A specified arrangement of the items in a set used in sequencing. *Syn*: **sequence (5).**

(3) * *See*: **order (2).**

* Deprecated.

collating significance. Any attribute of a set that may be used to define a specified arrangement to be used in collating.

collision. In hashing, the occurrence of the same hash value for two or more different keys. *Syn*: **hash clash.** *See also*: **synonym.**

collision chain. A list used in hashing to hold all the keys for which the hash address is identical. *Syn*: **calc chain.**

collision resolution. In hashing, the process of applying further calculations or other means to resolve a collision. Methods include open-address hashing, separate chaining, and the use of buckets. *Syn*: **rehashing.**

column. A vertically corresponding set of entries in a table. *See also*: **attribute (2).** *Contrast with*: **row.**

column sort. *See*: **distribution sort.**

column vector. A matrix with only one column. That is, a matrix of size m-by-1. *Contrast with*: **row vector.**

column-major order. A method for storing the elements of a matrix in computer memory, in which elements are ordered in a column-by-column manner, that is, all elements of column 1, followed by all elements of column 2, etc. *Contrast with*: **row-major order.**

combination. An unordered sequence of items chosen from a set. *See also*: **forbidden combination.** *Contrast with*: **permutation.**

command character. *See*: **control character.**

commercial character. (1) One of the set of characters used commonly in commercial operations; for example, CR (credit) and DB (debit).

(2) A character within a picture specification that represents one of the characters as in (1).

communication control character. *See*: **transmission control character.**

compare. To examine two items to determine their relative magnitudes, their relative positions in a given sequence, or whether they are identical.

comparison. (1) The process of examining two or more items for identity, similarity, equality, relative magnitude, or for order in a sequence.
(2) The result of such an examination as in (1).

complete binary tree. A complete tree of order 2. *Note*: The nodes in the tree can be read sequentially from left to right; top to bottom. *Syn*: **full binary tree.**

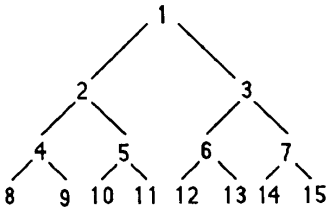

Fig 6
Complete Binary Tree

complete tree. A tree of order n in which each node has exactly n subtrees. *Syn*: **full tree.** *See also*: **heap.**

complex data. Numeric data used to represent complex numbers.

complex data structure. *See*: **nonprimitive data structure.**

complex number. A number consisting of a real part (a) and an imaginary part (b), expressed in the form $a + bi$, where $i^2 = -1$. [1084]

component data element. A component of a data structure. *Syn*: **component element; element.**

component element. *See*: **component data element.**

composite data element. A data element that contains two or more data elements that can be referred to either collectively or individually; for example, a data element named "date of birth" containing data elements "year," "month," and "day." *See also*: **data aggregate.** *Syn*: **data chain; molecular data element.** *Contrast with*: **atomic data element.**

compound key. A candidate key consisting of more than one attribute.

compound list. *See*: **list structure.**

computational data. *See*: **fixed-point data.**

computer program. A combination of computer instructions and data definitions that enable computer hardware to perform computational or control functions.

computer word. *See*: **word.**

concatenate. To append one item to the end of another so as to form a single unit in a contiguous pattern. For example, if we concatenate 'AP' with 'PLE,' the result is 'APPLE.' *Syn*: **catenate.**

concatenated key. (1) A key derived from the concatenation of two or more keys. *Syn*: **fully concatenated key; multifield key.**
(2) A concatenation of the keys for the first N segments found in a hierarchical path. For example, in the structure below, the concatenated key for segment x is "AFINANCE006."

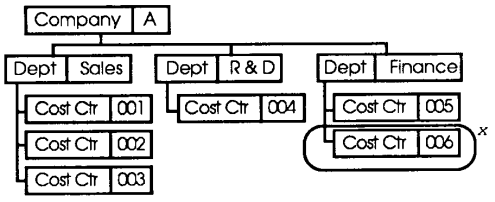

Fig 7
Concatenated Key

conceptual data definition language. A data definition language used to describe the format layout and contents of all data stored in a database, the result of which is a concep-

tual schema. *Note*: May also include authorization levels and validation procedures.

conceptual design. The process of developing a conceptual schema for a database.

conceptual model. *See*: **conceptual schema.**

conceptual record. A record within a conceptual view.

conceptual schema. (1) A description of the format and layout of the entire data contents of a database. *Note*: The schema is written using a conceptual data definition language. It may include authorization levels and validation procedures.
(2) The comprehensive, logical description of the information environment in which an enterprise exists, free of both the physical structure and application systems considerations. *Syn*: **conceptual model; enterprise view.** *Contrast with*: **external view; internal schema.**

conceptual view. The format and layout of the entire data content of a database, as described in a conceptual schema. *Note*: There may be many external views of a database, but only one conceptual view.

concurrent reorganization. Database reorganization in which users have access to the reorganized portion of the database while one or more reorganization processes are modifying other portions of the database.

condition. *See*: **atomic condition; item condition; qualification condition; query condition; record condition.**

Conference on Data Systems Languages (CODASYL). The organization that establishes industry standards for database structures.

conjunction. (1) The logical 'AND' operator.
(2) The result of joining two conditions by the logical 'AND' operator. *Contrast with*: **disjunction.** *See also*: **conjunctive query.**

conjunctive query. A database query formed by using one of the logical operators 'AND' and 'OR.'

consecutive spill method. *See*: **linear probing.**

consistency check. A check that verifies that an item of data is compatible with certain rules specified for that data. For example, one might wish to check the consistency between two data elements ORDER-DATE and DELIVER-DATE such that DELIVER-DATE may not be earlier than ORDER-DATE. *See also*: **crossfooting check; limit check; range check; validity check.**

containment. The result of placing all occurrences of a repeating group within the same logical record.

control character. (1) A character whose occurrence in a particular context initiates, modifies, or stops a control operation. A control character may be recorded for use in a subsequent action, and it may have a graphic representation in some circumstances. *See also*: **accuracy control character; device control character; print control character; transmission control character.** *Syn*: **command character; functional character; instruction character; operational character.**
(2) A character that initiates some kind of physical control action but is not printed on the output page. For example, line feed, tab, form feed.

control total. *See*: **hash total.**

controlled list. (1) A list whose access is controlled in some way; for example, access to an array is controlled by its index variable.
(2) A list that can contain a finite number of entries.

controlled list data element. A data element that is contained in a controlled list.

converse inorder traversal. The process of traversing a binary tree in a recursive fashion as follows: the right subtree is traversed, then the root is visited, then the left subtree is traversed. *Contrast with*: **converse postorder traversal; converse preorder traversal.** *See also*: **inorder traversal.**

converse postorder traversal. The process of traversing a binary tree in a recursive fash-

ion as follows: the right subtree is traversed, then the left subtree is traversed, then the root is visited. *Contrast with*: **converse inorder traversal; converse preorder traversal.** *See also*: **postorder traversal.**

converse preorder traversal. The process of traversing a binary tree in a recursive fashion as follows: the root is visited, then the right subtree is traversed, then the left subtree is traversed. *Contrast with*: **converse inorder traversal; converse postorder traversal.** *See also*: **preorder traversal.**

CR. (1) Acronym for the **carriage return character.**
(2) Abbreviation denoting the symbol for "credit."

cross-index. A link between two files containing related data. For example, in a library, the subject card catalog is a cross-index for the title and author card catalogs. *See also*: **cross-indexed file; inverted file.**

cross-indexed file. A file whose contents are linked with another file through a cross-index. *See also*: **inverted file.**

cross-indexing. (1) The process of linking entities in two files to facilitate searches performed on data contained in those files. *See also*: **cross-indexed file.**
(2) A method of linking entities as in (1).

crossfooting check. A consistency check in which two totals obtained by adding the same set of numbers in different sequences are compared.

currency symbol character. A character within a picture specification that represents the currency sign. *Note*: $ is commonly used.

DA. Acronym for **data administrator.**

DAM. Acronym for **direct access method.**

data. (1) Anything observed in the documentation or operation of software that deviates from expectations based on previously verified software products or reference documents. [P610.12, 1012]
(2) A representation of facts, concepts, or instructions in a manner suitable for communication, interpretation, or processing by humans or by automatic means. *Note*: "Data" is plural for datum, but is often used as a collective noun, as in "The data is in this file." *See also*: **data type; logical data; null data; numeric data; pointer data.** [P610.12]

data administrator (DA). An individual who is responsible for the definition, organization, supervision, and protection of data within some organization. *See also*: **database administrator.**

data aggregate. A collection of two or more data items that are treated as a unit. *See also*: **composite data element.** *Syn*: **aggregate; group item.**

data attribute. A characteristic of a unit of data.

data bank. (1) A collection of data libraries. *Note*: A record contains one or more items, a file contains one or more records, a library contains one or more files, and a data bank contains one or more libraries.
(2) A collection of data relating to a particular subject area. *Note*: The data may or may not be machine-readable.

data block. *See*: **block.**

data carrier. Material that serves as a data medium or to which a data medium is applied and that facilitates the transport of data; for example, a punch card, a disk, or a plastic card with a magnetic surface that serves as the data medium. *See also*: **data medium.**

data chain. *See*: **composite data element.**

data code. *See*: **code.**

data compaction. Any technique used to encode data in order to reduce the amount of storage it requires. *Contrast with*: **data compression.**

data compression. Any technique used to reduce the amount of storage required to store data. *Contrast with*: **data compaction.**

data conversion. To change data from one form of representation to another; for example, to convert data from an ASCII representation to an EBCDIC representation.

data definition. A description of the format, structure, and properties of a data item, data element, or data structure.

data definition language (DDL). (1) A language for describing the organization of data within a database. *Note*: In some software, the logical organization is described; in some, both the logical and physical organizations are described.
(2) A language used to describe the logical structure of a database. *Syn*: data description language; database description language; database descriptive language; schema definition language; schema language. *Contrast with*: data manipulation language. *See also*: database manipulation language; subschema data definition language.

data density. The amount of data that can be stored in one unit of data medium. For example, the number of bits stored in an inch of magnetic tape medium.

data description language. *See*: **data definition language.**

data dictionary. A collection of entries specifying the name, source, usage, and format of each data element used in a system or set of systems. *See also*: **data directory.** *Syn*: **data element dictionary.**

data dictionary system. A software system that maintains and manages a data dictionary.

data dictionary/directory (DD/D). *See*: **data dictionary; data directory.**

data directory. A collection of entries specifying the data name, source, location, ownership, usage and format of each data element used in some system or set of systems. *See also*: **data dictionary.**

data element. (1) A uniquely named and defined component of a data definition; a data "cell" into which data items (actual values) can be placed. For example, the data element AGE, into which data items 1, 2, ... can be placed. *Note*: The terms **data element** and **data item** are often used interchangeably or with the reverse definitions from those given here. No standard of use exists at this time. *Syn*: **cell.**
(2) A data definition as in (1) that cannot be divided into other individually named data definitions. *See also*: **attribute; data item.**

data element dictionary. *See*: **data dictionary.**

data element tag. *See*: **code.**

data entry. To input data into a computer system.

data exchange. (1) The use of data by more than one computer program or system. *See also*: **data interchange; exchange data.**
(2) The movement of data between two or more programs or systems.

data field. *See*: **attribute.**

data file. *See*: **file.**

data glossary. A collection of entries specifying a data definition and a specification of its uses.

data hierarchy. A set of directed relationships between two or more units of data, such that each unit has one and only one owner. *See also*: **hierarchy.**

data independence. The degree to which the logical view of a database is immune to changes in the physical structure of the database.

data integrity. The degree to which a collection of data is complete, consistent, and accurate. *See also*: **data security; database integrity; integrity.** *Syn*: **data quality.**

data interchange. The use of data by two or more different systems. *See also*: **data exchange.**

data item. A value contained in a data element; for example the data element AGE

might contain data items 1, 2, ... *Note*: The terms **data element** and **data item** are often used interchangeably or with the reverse definitions from those given here. No standard of use exists at this time. *See also*: **data element.**

data library. A set of related files, tables, or sets.

data link. The physical means of connecting two computers together for the purpose of transmitting and receiving data.

data management. The function of controlling the acquisition, analysis, storage, retrieval, and distribution of data.

data manipulation language (DML). A language used to retrieve, insert, delete, or modify the data in a database. *Syn*: **database manipulation language**. *Contrast with*: **data definition language.**

data medium. The material in or on which data is or may be represented. *See also*: **data carrier.**

data model. A description of data that consists of all entities represented in a data structure or database and the relationships that exist among them. *See also*: **logical data model; physical data model; schema; view.**

data name. One or more characters used to identify a data element.

data normalization. *See*: **normalization.**

data quality. *See*: **data integrity.**

data record. *See*: **record.**

data reduction. Any technique used to transform data from raw data into a more useful form of data. For example, grouping, summing, or averaging related data.

data resource. A purposely organized body of data that is of use to some person or group of people.

data security. The degree to which a collection of data is protected from exposure to accidental or malicious alteration or destruction. *See also*: **data integrity; database security.**

data set. A named collection of related records. *Note*: Often synonymous with file. *See also*: **partitioned data set.**

data storage description language. A language used to define the organization of stored data in terms that are independent of any particular storage device or operating system.

data storage schema. A data structure that describes the manner in which data items are physically stored in storage. *See also*: **database definition.**

data structure. A physical or logical relationship among a collection of data elements. *Syn*: **logical structure.** [P610.12]

data submodel. *See*: **external schema.**

data sublanguage (DSL). A subset of another language, called the host language, that is used to perform database operations. *Syn*: **database sublanguage.**

data translation. The modification of the physical representation of data used in one hardware/software environment so that it is compatible with a different hardware/software environment.

data type. A class of data, characterized by the members of the class and the operations that can be applied to them. *See also*: **data structure**. *Note*: Specific data types are defined in IEEE P610.12, *IEEE Standard Glossary of Software Engineering Terminology* [P610.12].

data value. The actual value that is stored in a data item. For example, the numeric value of the data item SALARY may be 20,000. *Syn*: **value.**

data volatility. The rate of change, over a specified period of time, in the values of stored data items.

data-break. *See*: **direct memory access.**

database. (1) A collection of logically related data stored together in one or more files. *Note*: Each data item is identified by one or more keys. *See also*: **database management system.**
(2) In CODASYL, the collection of all the record occurrences, set occurrences, and areas controlled by a specific schema.

database access method. A technique for organizing and storing a physical database in computer storage.

database administration (DBA). The responsibility for the definition, operation, protection, performance, and recovery of a database.

database administrator (DBA). An individual who is responsible for the definition, operation, protection, performance, and recovery of a database. *See also*: **data administrator.**

database command language (DBCL). A procedural data manipulation language used to access a database through a database management system.

database creation. The process of naming, allocating space, formatting, and defining a database. *See also*: **database definition; database design.**

database definition. (1) The process of translating a conceptual schema for a database into a data storage schema. *See also*: **database creation; database design; redefinition.**
(2) The result of such a translation.

database description language (DBDL). *See*: **data definition language.**

database descriptive language. *See*: **data definition language.**

database design. (1) The process of developing a conceptual schema for a database that will meet a user's requirements. *See also*: **database creation; database definition.** *Syn*: **implementation design.**
(2) The result of the process in (1).

database extract. A file, each record of which contains data items selected from a database based on a particular criterion.

database integrity. The degree to which the data in a database are current, consistent and accurate. *See also*: **data integrity; database security; integrity.**

database key. A field in a database that identifies a record in that database.

database management system (DBMS). A computer system involving hardware, software, or both that provides a systematic approach to creating, storing, retrieving and processing information stored in a database. A DBMS acts as an interface between computers' programs and data files as well as between users and the database. It may include backup/recovery, checkpoint processing, and ad-hoc query capability.

database manipulation language (DBML). *See*: **data manipulation language.**

database organization. The manner in which a database is structured; for example, a hierarchical organization, a relational organization. *See also*: **reorganization.**

database record. (1) A collection of data elements that are stored in a database.
(2) A collection of hierarchically dependent segments (one root and all its descendants) within a hierarchical database. *See also*: **record.**

database reorganization. *See*: **reorganization.**

database security. The degree to which a database is protected from exposure to accidental or malicious alteration or destruction. *See also*: **data security; database integrity.**

database segment. *See*: **segment.**

database sublanguage. *See*: **data sublanguage.**

database system. A software system that supports multiple applications using a common database.

Database Task Group (DBTG). A task group of the CODASYL Programming Language Committee that established a set of standards for specification and design of network database structures. *See also*: **CODASYL database.**

datum. Singular form for data.

daughter. *See*: **child node.**

DBA. Acronym for **database administration** or **database administrator.**

DBCL. Acronym for **database command language.** *See*: **database manipulation language.**

DBDL. Acronym for **database description language.** *See*: **data definition language.**

DBML. Acronym for **database manipulation language.**

DBMS. Acronym for **database management system.**

DBTG. Acronym for **Database Task Group.**

DD/D. Acronym for **data dictionary/directory.**

DDL. Acronym for **data definition language.**

deadlock. A situation in which computer processing is suspended because two or more devices or processes are each awaiting resources assigned to the other(s). For example, a situation in which computer program A, with an exclusive lock on record X, asks for a lock on record Y, which is allocated to computer program B. Likewise, program B is waiting for exclusive control over record X before giving up control of record Y. *Syn:* **deadly embrace.** [P610.12]

deadly embrace. *See*: **deadlock.**

deblock. To separate the parts of a block. *Syn*: **unblock.** *Contrast with*: **block.** [P610.12]

decimal alignment. An operation in which two or more decimal numbers are arranged such that their decimal points are aligned vertically; for example,

unaligned	aligned
1.4	1.4
5	5
.067	.067

decimal data. Data used to represent decimal numbers; that is, numeric values expressed in base 10. *See also*: **binary coded decimal real data; decimal picture data; packed decimal data; unsigned packed decimal data; zoned decimal data.**

decimal picture data. Arithmetic picture data that is associated with a picture specification that allows decimal digit characters, a radix point, zero-suppression characters, sign characters, currency symbol characters, insertion characters, commercial characters, and exponent characters. *Syn*: **numeric character data.** *Contrast with*: **binary picture data.**

decode. To convert data by reversing the effect of previous encoding. *Contrast with*: **encode.**

decoder. A device or system that decodes data. *Contrast with*: **encoder.**

decollate. To divide the items in a set into unique subsets. *Contrast with*: **collate.**

default. (1) Pertaining to a value, attribute, or option that is assumed in place of a value, attribute or option when one is required, but not specified explicitly; for example, the default value for a field called MARITAL STATUS might be M (for married).
(2) To assign the value, attribute, or option as in (1).

definition. *See*: **database definition.**

degenerate tree. A tree in which each nonterminal node has exactly one subtree.

degree. (1) With regard to a relation, the number of attributes in that relation.
(2) With regard to a given node in a tree, the number of subtrees within that node.

DEL. Abbreviation for the **delete character.**

delete. (1) To remove data from a storage device or data medium. *See also*: **read; update; write.** *Syn*: **erase; physical delete.**
(2) To render data unretrievable, although it may continue to be physically present on a storage device. *Syn*: **logical delete.**

delete access. A type of access to data in which the data may be deleted. *See also*: **read-only access; read/write access; update access; write access.**

delete character (DEL). A control character used to obliterate an erroneous or unwanted character. *Note*: On a perforated tape, this character consists of a card hole in each punch position. *Syn*: **erase character; rub-out character.**

deletion record. (1) A record that indicates that data is to be deleted.
(2) A record that has been deleted from a master file. *Contrast with*: **add record.**

delimiter. A bit, character, or set of characters used to denote the beginning or end of a group of related bits, characters, words, or statements. For example, the ampersand "&" in the character string "&APPLE&." *Syn*: **separator.** [P610.12]

delink. To retrieve and delete an item from a linked list.

dense list. *See*: **packed array.**

dependency. *See*: **functional dependency; join dependency; multivalued dependency; non-transitive dependency; transitive dependency.**

dependent segment. In a hierarchical database, a segment that is not the root segment.

depth. *See*: **height.**

depth-first search (DFS). A search of a tree using preorder traversal.

deque. Acronym for **double-ended queue.** Pronounced "deck."

dequeue. To retrieve and delete an item from a queue. *Contrast with*: **enqueue.**

derived data. Data that is computed or otherwise obtained from other data by application of a specified procedure.

derived data element. A data element whose entries are obtained from those in another data element by application of a specified procedure; for example, entries in a data element "age" could be derived from entries in the data element "date of birth."

derived relation. A relation in a database that can be entirely obtained from previously defined base relations by applying some sequence of relational operators. *Contrast with*: **base relation.**

descendant node. In a tree, a node that is in a subtree of a given node. *See also*: **ancestor; parent node; root note.**

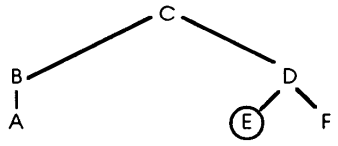

Fig 8
Node E Is a Descendant Node of Nodes C and D

design. *See*: **database design.**

determinant. Within a relation, an attribute on which some other attribute is functionally dependent.

device control character. A control character used for the control of auxiliary devices associated with a data processing system or data communication system; for example, a control character for switching such devices on or off.

device media control language. A language that may be used to describe the physical layout and organization of data within some physical storage media.

DFS. Acronym for **depth-first search.**

dibit. Two bits.

dichotomizing search. A search in which an ordered set of items is partitioned into two parts, one of which is rejected, and the process is repeated on the accepted part until the search is completed. *See also*: **binary search; fibonacci search; interpolation search.**

dictionary. A list of data items and information about those items, used both to describe and to reference the items. *See also*: **data dictionary; index; table.** *Syn*: **look-up table.** *Contrast with*: **directory.**

dictionary/directory. *See*: **data dictionary; data directory.**

difference. A relational operator that combines two relations having identical attributes and results in a relation containing the tuples that are in the first but not the second relation. *Syn*: **minus; set difference.** *See also*: **intersection; join; product; projection; selection; union.**

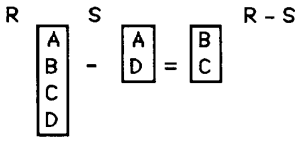

Fig 9
Difference

digit. A symbol that represents one of the nonnegative integers smaller than the radix; for example, in decimal notation, a digit is one of the characters 0 1 2 3 4 5 6 7 8 9. *Syn*: **numeric character.**

digit transformation function. A hash function that returns a permutation of the original key with one or more digits removed. For example, in the function below, every other digit is dropped from the original key.

Original key	Hash value
964721	942
78394	734

digital search tree. A search tree in which the order of the keys is representational of the data contained in the tree. For example, a thumb-index of a dictionary that organizes the alphabet by groups of three or four letters; ABC, DEF, GHI, ... WXYZ.

digital sort. A radix sort in which base 10 notation is used.

digital tree search. A radix search in which the items in the set to be searched are placed in a tree according to the digital representation of the search keys. *Note*: The tree is traversed in a top-down fashion making comparisons on the bit representations until a match is found for the search argument or the lowest-level node of the tree is encountered. *See also*: **binary tree search.**

digraph. *See*: **directed graph.**

diminishing increment sort. An insertion sort in which the items in the set to be sorted are divided into subsets, each containing N items; the corresponding items in the subsets are ordered using an insertion sort; and this process is repeated using subsets of diminishing size until the subsets are of size 1. *Syn*: **Shell sort; Shell's method.**

direct access. Pertaining to the process of storing and retrieving data using direct access mode. *Contrast with*: **sequential access.** *See also*: **indexed access; indexed sequential access.**

direct access method (DAM). An access method in which the access time required to access data is effectively independent of the location of the data. *See also*: **basic direct access method; direct data set.** *Contrast with*: **basic access method; queued access method.**

direct access mode. An access mode in which data records are stored and retrieved from storage in such a way that the location of a data record can be derived from the value of some element or elements in the record, regardless of the contents of other data records. *Contrast with*: **indexed sequential access mode; sequential access mode.**

direct chaining. *See*: **separate chaining.**

direct data set. A file that is accessed using the direct access method. *Contrast with*: **sequential file.**

direct lookup. A table lookup in which the position of an entry is computed as a function of its key value.

direct memory access (DMA). Access to data by which data is transferred directly between main memory and storage devices.

direct memory access controller (DMAC). The block transfer processor used to implement direct memory access.

direct-access merge sort. An external merge sort in which the auxiliary storage used is direct-access storage. *See also*: **tape merge sort.**

directed graph. A diagram or other representation consisting of a finite set of nodes and one-directional connections between them. *Syn*: **digraph.** *Contrast with*: **undirected graph.** [P610.12]

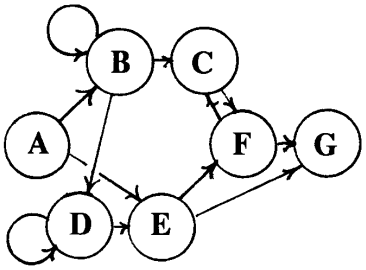

Fig 10
Directed Graph

directory. (1) A list of data items and information about those items, used to reference the items; for example, the directory for each user's personal disk space contains an entry for each file within that space, and a reference to its physical location. *Contrast with*: **dictionary.** *See also*: **data directory; file directory.**
(2) *See*: **index.**

dirty read. To access data from a storage device or data medium while that same data is being modified by another process. *Syn*: **transient read.**

disjunction. (1) The logical 'OR' operator.
(2) The result of joining two conditions by the logical 'OR' operator. *Contrast with*: **conjunction.** *See also*: **conjunctive query.**

distributed database. (1) A database that is not stored in its entirety at a single physical location, but is dispersed over a network of interconnected computers.
(2) A database under the overall control of a central database management system, whose storage devices are not all attached to the same processor.

distribution counting sort. An insertion sort in which the sort keys of the items to be sorted fall within some finite range of values, and by counting the number of sort keys having each value, the position of the items in the sorted set can be determined.

distribution sort. A sort in which the set to be sorted is divided into two or more subsets such that all items within each subset are within some exclusive range. Each subset is sorted, then the subsets are joined in the correct order. *Syn*: **column sort; distributive sort; pocket sort; separation sort.** *See also*: **digital sort; radix sort.** *Contrast with*: **merge sort.**

distributive sort. *See*: **distribution sort.**

divide-and-conquer sort. *See*: **radix exchange sort.**

division transformation function. A hash function that returns the remainder from the division of some value into the original key. For example, in the function below, the original key is divided by 997.

Original Key	Calculation	Hash Value
35721	35721/997 = 35 R 826	826
87452	87452/997 = 87 R 713	713

DMA. Acronym for **direct memory access.**

DMAC. Acronym for **direct memory access controller.**

DML. Acronym for **data manipulation language.**

domain. (1) The set of all possible values that can be taken on by an independent variable.

(2) In a relational data model, the set of all possible values that can be taken on by some attribute. For example, the domain of a three-digit positive integer is [001, 002, 003, ..., 999].

double hashing. Open-address hashing in which collision resolution is handled by using a second hash function to determine a fixed increment and adding multiples of this increment to the original hash value until an empty position is found in the hash table.

double length. *See*: **double precision.**

double precision. Pertaining to the use of two computer words to represent a number in order to preserve or gain precision. *Syn*: **double length**. *Contrast with*: **single precision; multiple precision; triple precision**. [1084]

double-ended queue (deque). A list whose contents may be changed by adding or removing items at either end. *Note*: This data structure is inaccurately named because it contradicts the definition of queue.

doublet. A group of two adjacent digits operated upon as a unit. [1084]

doubleword. A contiguous sequence of bits or characters that comprises two computer words and can be addressed as a unit.

doubly-chained tree. *See*: **doubly-threaded tree.**

doubly-linked list. A linked list in which each item contains two pointers, one pointing forward to the next item in the list, and one pointing backward to the previous item in the list. *Syn*: **two-way chain**.

doubly-threaded tree. A binary tree in which each node contains two link fields; one each for its successor and predecessor nodes with respect to some traversal. *Syn*: **doubly-chained tree**. *Contrast with*: **triply-threaded tree.**

download. (1) To transfer some collection of data from a computer memory to another storage location.
(2) To transfer some collection of data from the memory of one computer to the memory of a second computer that is relatively smaller than the first; for example, to transfer data from a mainframe computer to a microcomputer.

DSL. Acronym for **data sublanguage**.

dummy. Pertaining to a nonfunctioning item used to satisfy some format or logic requirement or to fulfill prescribed conditions. For example, a dummy report containing only titles and column headings with place-holding data instead of real data.

dummy data. Data that is used to satisfy some format or logic requirement or to fulfill prescribed conditions. For example, an artificial character used as a placeholder variable within a program.

duplicate. To copy data from a source to a destination that has similar physical form as the source. *Syn*: **reproduce**.

duplication check. A check that requires that the results of two independent performances of the same operations be identical.

dynamic restructuring. The process of restructuring a database, data structure, computer program, or set of system components during program execution. For example, concurrent reorganization of a database. [P610.12]

echo check. A check in which information that has been transmitted is returned to the information source and compared with the original information to ensure accuracy of the transmission. *Syn*: **read-back check.**

element. *See*: **binary element; data element.**

embedded data dictionary. *See*: **active data dictionary.**

empty medium. A data medium that does not contain data.

encode. To represent data in symbolic form using a code or a coded character set such

that reconversion to the original form is possible. *Note*: Sometimes used when complete reconversion is not possible. *Contrast with*: **decode**. *See also*: **code**.

encode-decode table. *See*: **code-decode table**.

encoded data. *See*: **code (2)**.

encoder. A device or system that encodes data. *Contrast with*: **decoder**.

end of file (EOF). An internal label, immediately following the last record of a file, signalling the end of that file. *Syn*: **end-of-file**.

end-of-file. *See*: **end of file**.

end-of-volume label. An internal label that precedes and initiates the beginning of the data contained in that volume. *Syn*: **volume label**.

end-point. *See*: **terminal node**.

end-user language. *See*: **query language**.

endorder traversal. *See*: **postorder traversal**.

enqueue. To append an item to a queue. *Contrast with*: **dequeue**.

enterprise view. *See*: **conceptual view**.

entity. In data management, a distinguishable object, either real or abstract, about which data are recorded; for example, a person such as a CUSTOMER, or a concept, such as SALES-REVENUE, about which data is stored in a data structure. *Syn*: **entity instance**.

entity class. *See*: **entity set**.

entity instance. *See*: **entity**.

entity set. A collection of entities that have similar properties, such as a set of CUSTOMERS. *Syn*: **entity class**; **entity type**.

entity type. *See*: **entity set**.

entity-relationship data model. A logical view of data within a system, representing the entities in the system as well as relationships among the entities, attributes of the entities, and attributes of the relationships.

entity/attribute matrix. A representation of a relation in the form of a matrix such that each row represents an entity and each column represents an attribute of the entity. (See Fig 11, Entity/Attribute Matrix *Students*.)

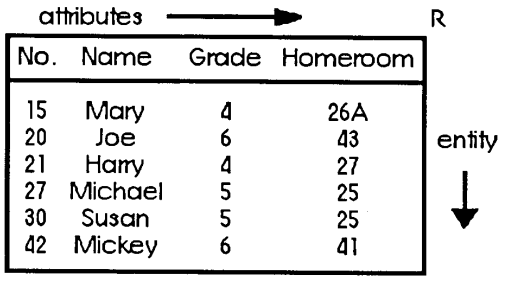

Fig 11
Entity/Attribute Matrix *Students*

entry. An element of information in a data structure, that describes an identifiable entity; for example, a member of a table, list, or queue. *See also*: **data entry**.

EOF. Acronym for **end of file**.

erase. *See*: **delete**.

erase character. * *See*: **delete character**.
* Deprecated.

error character. A control character used to indicate that an error exists in the data or has occurred during transmission.

error control character. *See*: **accuracy control character**.

ESC. Abbreviation for the **escape character**.

escape character (ESC). A code extension character used, in some cases with one or more succeeding characters, to indicate by some convention or agreement that the coded

representations following the character or the group of characters are to be interpreted according to a different code or according to a different coded character set.

estimated entry search. *See*: **interpolation search.**

exchange data. Data that is received or transmitted via data exchange in an appropriate format. *See also*: **data exchange.**

exchange selection sort. *See*: **bubble sort.**

exchange sort. A sort in which pairs of items in a set are examined in some sequence, pairs found out of order are exchanged, and the process is repeated until all items are in the correct order. Multiple passes are usually required. *See also*: **Batcher's parallel sort; bubble sort; cocktail shaker sort; quicksort; radix exchange sort.**

exclusive lock. A lock that grants the holder sole access to the locked data. No other process can access the data for either read or write purposes. *Contrast with*: **shared lock.**

exponent character. (1) A character within a picture specification that represents the beginning of the exponent within a floating point number. *Note*: K and E are commonly used.
(2) A character within a picture specification that represents the scaling factor for a decimal number. Specified with an integer constant, it indicates the number of decimal positions the decimal point is to be moved from its assumed position to the right (if the constant is positive) or to the left (if the constant is negative). *Note*: F is commonly used.

extended binary tree. A full binary tree in which all terminal nodes contain data.

extent. A continuous area of storage on a direct access data medium, occupied by or reserved for a particular file. *See also*: **primary space allocation; secondary space allocation.**

external chaining. *See*: **separate chaining.**

external data file. (1) A data file that is sorted on an external storage medium such as a magnetic tape.
(2) A data file that is stored apart from the system using the data.

external data model. A data model depicting entities within a specific application or type of application in an organization. *Contrast with*: **internal model.**

external data submodel. *See*: **external schema.**

external entry search. *See*: **interpolation search.**

external label. A label, usually not machine-readable, attached to a data medium container; for example, a paper sticker attached to the outside of a reel of magnetic tape. *Contrast with*: **internal label.**

external merge sort. A merge sort that makes use of auxiliary storage. *See also*: **balanced merge sort; direct-access merge sort; multiway merge sort; oscillating sort; tape merge sort; unbalanced merge sort.** *Contrast with*: **internal merge sort.**

external node. *See*: **terminal node.**

external record. A record within an external view.

external schema. (1) A description of the format, layout, and contents of the data, within a database, to be employed by a user or application program. *Note*: The schema is written using the data definition portion of the data sublanguage. *Syn*: **logical view; data submodel.** *See also*: **external database model.** *Contrast with*: **conceptual schema; internal schema.**
(2) A logical description of an organization or enterprise. *Note*: The external schema may differ from the conceptual schema in that some entities, attributes, or relationships may be omitted, renamed, or otherwise transformed.
(3) A description of the user's view of data. *Syn*: **external data submodel; view; subschema.**

external sort. A sort that requires the use of

auxiliary storage. *Contrast with*: **internal sort.**

external view. The format, layout, and contents of the data in a database that a user or application program uses, as described in an external schema. *See also*: **external record.** *Contrast with*: **conceptual schema.**

extract. To pick, from a set of items, all items that meet a particular criterion. *See also*: **database extract; select.**

F format. Abbreviation for **fixed format.**

father. *See*: **parent node.**

father file. A file that contains data that have since been updated in another file, called the son file. *See also*: **grandfather file.**

FCFS. Acronym for **first-come, first-served.** *See*: **first-in, first-out.**

FE. Acronym for **format effector character.**

FEFO. Acronym for **first-ended, first-out.**

FF. Acronym for **form feed character.**

fibonacci search. A dichotomizing search in which, at each step in the search, the set of items is partitioned in accordance with the Fibonacci series. For example, a set of 8 items is partitioned to 5 and 3, the subset of 5 is partitioned to 3 and 2, and so on. If the number of items in the original set is other than a Fibonacci number, the next higher Fibonacci number is used to partition the set. *Contrast with*: **binary search; interpolation search.**

field. (1) A specified area within a record, used for a particular data item; for example a group of card columns in which a telephone number is recorded.
(2) The smallest unit of data that can be referred to in a database. *See also*: **database segment.**

field length. The number of words or characters in a field.

field length type. An indication of whether the field is fixed or variable in length. *Note*: If a field is a variable length type, the field length expresses the maximum length possible.

field separator. A character or byte used to identify a boundary between two fields.

field-locking. *See*: **lock.**

FIFO. Acronym for **first-in, first-out.**

fifth normal form (5NF). One of the forms used to characterize relations; a relation is said to be in fifth normal form if it is in fourth normal form and if every join dependency in the relation is a consequence only of the candidate keys of the relation. *Syn*: **projection/join normal form.**

file. A set of related records treated as a unit. For example, in stock control, a file could consist of a set of invoice records. *See also*: **data file; data set; logical file.** [P610.12]

file access mode. The type of access allowed for a given file and a given user. For example, the file access mode for a given file might be read-only access for one user, and read/write access for another. *Syn*: **access type.**

file attribute. A property, feature, or characteristic of a file.

file cleanup. The removal of superfluous data from a file. *Syn*: **file tidying.**

file directory. (1) A list of files and their locations within a computer system. *See also*: **catalog.**
(2) A list of the files and their locations on a particular storage device or volume.

file gap. An unused area on a data medium between the end of one file or group of data

and the beginning of another file or group of data.

file layout. The arrangement and structure of data in a file. *Syn*: **file organization.**

file maintenance. The activity of adding, changing, or deleting data in a file as needed.

file name. (1) One or more characters used to identify a file.
(2) A name associated with a set of file data or output data.

file organization. (1) *See*: **file layout.**
(2) The order of physical records within a file that determines the access method to be implemented in order to use the file.

file tidying. *See*: **file cleanup.**

file-locking. *See*: **lock.**

fill. *See*: **character fill; filler character; zero fill.**

filler. One or more data items adjacent to an item of data that forces that item to take on a specified size; for example, in an 80-character output record in which a 30-character NAME, 20-character ADDRESS, and a 3-character AGE is to be placed, filler would be used to expand the data to be 80 characters. *See also*: **character fill; pad; padding.**

filler character. (1) A character used to occupy an area on a printed medium; for example, on a legal document, dashes or asterisks used to fill out a field to ensure that nothing is added to the field once the document has been issued. *See also*: **filler.**
(2) A character that does not itself convey data but that may delete unwanted data, as in blanks used to fill out a field. *See also*: **character fill.**

FILO. Acronym for **first-in, last-out.** *See*: **last-in, first-out.**

first normal form (1NF). One of the forms used to characterize relations; a data structure or relation is said to be in first normal form if it has no repeating groups. For example:

UNNORMALIZED

ORDER0 = {ORDER-NO} + DATE + CUSTOMER-NO
+ CUSTOMER-NAME + CUSTOMER-ADDRESS
+ ((SEQUENCE-NO + ITEM-NO + ITEM-DESCRIPTION
+ QUANTITY-ORDERED + UNIT-PRICE
+ EXTENDED-PRICE)) + TOTAL-ORDER-AMOUNT

FIRST NORMAL FORM

ORDER1 = {ORDER-NO} + DATE + CUSTOMER-NO
+ CUSTOMER-NAME + CUSTOMER-ADDRESS
+ TOTAL-ORDER-AMOUNT

ITEM1 = {ORDER-NO + SEQUENCE-NO} + ITEM-NO
+ ITEM-DESCRIPTION + QUANTITY-ORDERED
+ UNIT-PRICE + EXTENDED-PRICE

Note: repeating group enclosed in parenthesis. Keys in brackets.

Fig 12
First Normal Form

first-come, first-served (FCFS). *See*: **first-in, first-out (FIFO).**

first-ended, first-out (FEFO). A queueing technique for concurrent processes in which items are retrieved from the queue based on the time at which the item is placed completely in the queue. That is, the item whose final segment is placed in the queue before those of all other items, will exit the queue before those other items. *Note*: Often used in message queueing applications.

first-in, first-out (FIFO). (1) A technique for managing a set of items to which additions and deletions are to be made; items are appended to one end of a list and retrieved from the other end. *See also*: queue.
(2) Pertaining to a system in which the next item to exit the system is the item that has been in the system for the longest time. *Contrast with*: **last-in, first-out.** *Syn*: **first-come, first-served.**

first-in, last-out. *See*: **last-in, first-out.**

five-bit byte. *See*: **quintet.**

fixed. *See*: **read-only access.**

fixed binary data. *See*: **fixed-point binary data.**

fixed decimal data. *See*: **fixed-point real data.**

fixed format (F format) . A file organization in which all logical records in the file are of fixed length. *Contrast with*: **variable format.**

fixed real data. *See*: **fixed-point real data.**

fixed length. Pertaining to a record or field that has a constant length, regardless of the specific data contained in it. Filler characters may be used to maintain the fixed length. *Contrast with*: **variable length.** *See also*: **fixed format.**

fixed length field. A field whose length is constant. *Contrast with*: **variable length field.** *See also*: **fixed format.**

fixed-point. Pertaining to a numeration system in which the position of the radix point is fixed with respect to one end of the numerals, according to some convention. *Contrast with*: **floating point; variable point.** [1084]

fixed-point binary data. Fixed-point data used to represent signed binary numbers. *Syn*: **fixed binary; real fixed binary data.**

decimal	75_{10}
fixed-point binary	$0100\,1011_2$
decimal	-91_{10}
fixed point binary	$1010\,0101_2$

fixed-point data. Integer data that can be expressed in a specific number of digits, with a radix point implicitly located at a predetermined position. *See also*: **fixed-point binary data; fixed-point real data.** *Contrast with*: **floating-point data.** *Syn*: **computational data.**

fixed-point real data. Fixed-point data used to represent signed decimal numbers. For example, 75.6, 0, and -253. *Syn*: **fixed decimal data; fixed real data; real fixed decimal data.**

flat file. (1) A set of records that are identically formatted to contain no more than one occurrence of each data item. *Note*: records in such a file do not contain data aggregates or repeating groups. *See also*: **relational file.**
(2) A two-dimensional array of data items that is stored as in (1).

flex model. *See*: **CODASYL model.**

floating point. Pertaining to a numeration system in which each number is represented as a fractional quantity multiplied by an integral power of the radix. *Contrast with*: **fixed point; variable point.** [1084]

floating-point data. Real data in which numbers are represented using only an exponent, y, and a mantissa, x, where x and y are integers. *Note*: The number is expressed in the form $x \cdot 10^y$, and only x and y are stored in fixed-point binary format. *Syn*: **floating-point real data.** *Contrast with*: **fixed-point data.**

decimal	$12.3 = .123 \cdot 10^2$
floating-point	$0111\,1011\,0000\,0010_2 = 7B02_{16}$
	----x---- ----y----

floating-point real data. *See*: **floating-point data.**

forbidden character. *See*: **illegal character.**

forbidden combination check. A check in which a combination of bits or other representations is not valid according to some criteria. *Contrast with*: **illegal character.**

foreign key. (1) An attribute that is a primary key, not to the record it is in, but to some related record.
(2) In a relational data model, nonprime attributes of some relation that is defined on the same domain as a prime attribute of another relation.

forest. A set of disjoint trees.

form feed character (FF). A format effector character that causes the print or display position to move to the next predetermined first line on the next form, the next page, or the equivalent. *Syn*: **page eject character; paper throw character.** [ANDIPS/ISO]

format. The arrangement, order, or layout of data in or on a data medium. *See also*: **fixed format; variable format.**

format character. A control character used to control a printer.

format effector character (FE). Any control character used to control the positioning of printed, displayed, or recorded data. *Syn*: **layout character.** *See also*: **back space character.** [ANDIPS/ISO]

formatted information. Information that has been arranged into discrete units and structures in a manner that facilitates its access and processing. *Contrast with*: **narrative information.**

forward recovery. The reconstruction of a file to a given state by updating an earlier version, using data recorded in a chronological record of changes made to the file. *Contrast with*: **backward recovery; inline recovery.** [P610.12]

four-bit byte. *See*: **quartet.**

fourth normal form (4NF). One of the forms used to characterize relations; a relation R is said to be in fourth normal form if it is in Boyce/Codd normal form and if, when there exists a non-trivial multivalued dependency A -> -> B, then all attributes in R are also functionally dependent on A.

full backup. To perform a backup in which all data within a system is stored on the backup copy. *Contrast with*: **incremental backup.**

full binary tree. *See*: **complete binary tree.**

full functional dependency. A functional dependency in which no attribute of the determinant can be omitted without voiding the dependent condition.

full tree. *See*: **complete tree.**

fullword. *See*: **word.**

fully concatenated key. *See*: **concatenated key.**

fully inverted file. An file that has been inverted on all secondary keys in the file. *Contrast with*: **partially inverted file.**

fully relational. Pertaining to a database management system that supports a relational database and a language that provides the functionality of the relational algebra.

functional character. *See*: **control character.**

functional dependency. A type of dependency between two attributes A and B in a relation, in which B is functionally dependent on A if, and only if, at every instant in time, each value of A is associated with no more than one value of B. *Note*: A is said to "identify" or "functionally determine" B. Written A -> B. *See also*: **full functional dependency; join dependency.**

functionally determined. *See*: **functional dependency.**

gap character. A character that is included in a computer word for technical reasons but that does not represent data.

garbage. Unwanted or meaningless data.

garbage collection. (1) In data management, a space optimization technique in which superfluous data are eliminated.
(2) In data management, a database reorganization technique in which the contents of a database are made more compact by physically deleting garbage such as records that have been deleted logically but remain physically in the database.

GDG. Acronym for **generation data group.**

generation data group (GDG). A collection of data files that are kept in chronological order and referenced by its generation

number. *Note*: Each file is called a generation data set.

generation data set. One data file within a generation data group.

generic data element. A data element related to or drawn from a large class of like data elements.

get. (1) To retrieve an item from a set of items as in retrieving a record from a file, or in obtaining a numerical value from a series of decimal digits. *Contrast with*: **put.**
(2) To select and retrieve a group of specified records from a database.

get next. To select and retrieve the next record from a database that meets some specified criteria. *Note*: Used in conjunction with a placeholder point. *Contrast with*: **get unique.**

get unique. To select and retrieve the first record from a database that meets some selection criteria. *Contrast with*: **get next.**

glossary. *See*: **data glossary.**

grandfather file. A file that contains data that have since been updated in another file, called the father file, and further updated in a third file, called the son file.

graph. A diagram or other representation consisting of a finite set of nodes and internode connections called edges or arcs. *See also*: **directed graph; undirected graph.** [P610.12]

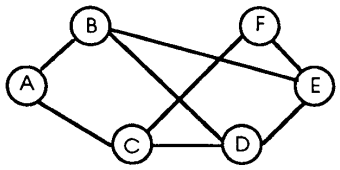

Fig 13
Graph

group. A set of items that are related to each other in some way; for example, a set of records that have the same value for a particular field, or a set of files in a generation data group.

group item. *See*: **data aggregate.**

hardware check. *See*: **automatic check.**

hash. To calculate the hash value for a given item. *See also*: **hashing.**

hash address. *See*: **hash value.**

hash addressing. *See*: **hashing.**

hash clash. *See*: **collision.**

hash coding. *See*: **hashing.**

hash function. In hashing, the function used to determine the position of a given item in a set of items. *Note*: The function operates on a selected field, called a key, in each item and the function is generally a many-to-one mapping. *Syn*: **calc algorithm; key transformation function.** *See also*: **algebraic coding function; digit transformation function; division transformation function; key folding function; key transformation; mid-square function; multiplication transformation function; radix transformation function.**

hash index. *See*: **hash value.**

hash search. The use of a hash function and collision resolution to locate an item in a hash table.

hash table. A two-dimensional table of items in which a hash function is applied to the key of each item to determine its hash value. The hash value identifies each item's primary position in the table, and if this position is already occupied, the item is inserted either in an overflow table or in another available position in the table.

hash total. The result of summing two or more values of a set for purposes of validation or error detection. *Syn*: **control total.**

hash value. The number generated by a hash function to indicate the position of a given

item in a hash table. *Syn*: **hash address; hash index.**

hashing. A technique for arranging a set of items, in which a hash function is applied to the key of each item to determine its hash value. The hash value identifies each item's primary position in a hash table, and if this position is already occupied, the item is inserted either in an overflow table or in another available position in the table. *Syn*: **hash coding; hash-addressing; randomizing; scatter storage.** *See also*: **collision resolution; open-address hashing; separate chaining.**

HDAM. Acronym for **hierarchical direct access method.**

head. The first data item in a list. *Syn*: **header (2).**

header. (1) Pertaining to data that describes and pertains to other data. For example, the header record for a file might describe the format for the remaining records in the file. (2) *See*: **head.**

header label. An internal label, immediately preceding the first record of a file, that identifies the file and contains data used in file control.

heap. A complete binary tree in which the key for each child node contains the key from its parent plus some additional value.

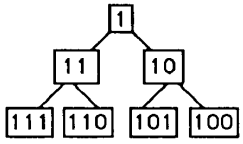

Fig 14
Heap

heapsort (heap sort). A tree selection sort in which the items to be sorted are used to build a heap, and the items are then selected from the heap in the sorted order.

height. In a tree, the maximum number of levels between the root node and a terminal node. *See also*: **height-balanced tree.** *Syn*: **depth.**

height balance. In a tree, the maximum difference in height of any two subtrees of any node. *Note*: A height balance of k is writter HB.

height-balanced k-tree. A tree whose height balance is k.

height-balanced tree. A tree whose height balance is 1. *See also*: **Adel'son-Velskii and Landis (AVL) tree; B-tree; *n-m* tree.** *Contrast with*: **weight-balanced tree.** *Syn*: **balanced tree.**

help file. A file containing help information.

HIDAM. Acronym for **hierarchical indexed direct access method.**

hierarchical. Pertaining to a hierarchy, as in a hierarchical database or a hierarchical structure.

hierarchical database. A database in which data are organized into records, known as segments, that represent nodes in a hierarchy or tree structure. *Note*: Within the hierarchy, a subordinate to a given segment is known as its child segment and a superordinate is known as its parent segment. *Contrast with*: **network database; relational database.** *Syn*: **sequential precedential database.**

hierarchical direct access method (HDAM). A database access method for hierarchical databases in which pointers maintain the structure itself as well as the control of the storage and retrieval functions of the database. All records are stored and retrieved using these pointers. *Contrast with*: **hierarchical sequential access method.** *See also*: **hierarchical indexed direct access method; hierarchical indexed sequential access method.**

hierarchical indexed direct access method (HIDAM). A database access method for hierarchical databases in which indices access root segments and pointers access dependent segments. *Contrast with*: **hierarchical indexed sequential access method.**

hierarchical indexed sequential access method (HISAM). A database access method for hierarchical databases in which indices control access to both root and dependent segments. *Contrast with*: **hierarchical indexed direct access method.**

hierarchical model. (1) A data model whose pattern of organization is in the form of a tree structure.
(2) A data model that provides a tree structure for relating data elements, where each node of the tree corresponds to a group of data elements or a record type, and has only one superior node or parent.

hierarchical sequence. In a hierarchical database, the sequence of root and dependent segments defined by traversing the database in some specified order.

hierarchical sequential access method (HSAM). A database access method for hierarchical databases in which data items are stored and retrieved sequentially. *See also*: **hierarchical indexed sequential access method.** *Contrast with*: **hierarchical direct access method.**

hierarchical structure. A collection of entities that are organized in a hierarchical fashion. *Contrast with*: **network structure.**

hierarchy. A structure in which components are ranked into levels of subordination; each component has zero, one, or more subordinates; and no component has more than one superordinate component. *See also*: **data hierarchy; hierarchical database; link; network; tree.** [P610.12]

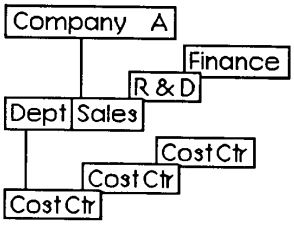

Fig 15
Hierarchy

high order position. The leftmost position in a string; for example, the letter 'A' in 'APPLE' or the digit 9 in 965. *Contrast with*: **low order position.** *See also*: **most significant character; most significant digit.**

HISAM. Acronym for **hierarchical indexed sequential access method.**

hit. (1) In a search, the condition that occurs when the key value of an item is equal to the search argument; that is, a successful search results in a hit.
(2) A record that produces the condition in (1); for example, a student record in which the student's home state matches the home state being searched for. *Contrast with*: **match.**

hit file. A file containing all records that resulted from a successful search.

hit ratio. In a search, the number of hits divided by the total number of items searched.

hold. When performing a get operation on a record, to lock the record for update by the requesting process at the same time the get operation is performed.

horizontal tabulation character (HT). A format effector character that causes the print or display position to move forward to the next of a series of predetermined positions along the same horizontal line.

host language. A programming language such as COBOL or PL/I into which data manipulation language statements are embedded. *See also*: **data sublanguage.**

HSAM. Acronym for **hierarchical sequential access method.**

HT. Acronym for the **horizontal tabulation character.**

identified. *See*: **functional dependency.**

idle character. A control character that is sent when there is no information to be sent.

illegal character. A character or combination of bits that is not valid according to some criteria; for example, a character that is not a member of some specified alphabet. *Contrast with*: **forbidden combination.** *Syn*: **forbidden character; improper character.**

immediate access. Access to a storage device or register in which access time is virtually equal to zero. *Note*: Access time measured in nanoseconds is considered to be virtually equal to zero. *Syn*: **instantaneous access; simultaneous access.**

implementation design. *See*: **database design.**

improper character. *See*: **illegal character.**

in-core sort. *See*: **internal sort.**

incremental backup. To perform a backup of a system in which the only data that is stored on the backup is data that has been modified since the last full backup was performed. *Contrast with*: **full backup.**

index. (1) A data item that identifies a particular element in a set of items such as an array.
(2) A list or table used to locate records within an indexed file that contains the location and unique key value of each record. *Syn*: **directory.** *See also*: **cross-index.**
(3) To prepare a table as in (2).

indexed access. The process of accessing stored data in such a way that indices are used to locate records within data storage. *Syn*: **keyed access.** *See also*: **indexed sequential access.**

indexed file. A file that may be accessed using an index. *Contrast with*: **partitioned data set; sequential file.**

indexed segment. In a database, a segment that is located by an indexing segment. *Syn*: **index target segment.**

indexed sequential access. The process of accessing stored data using the indexed sequential access mode. *Contrast with*: **direct access; sequential access.** *See also*: **indexed access.**

indexed sequential access method (ISAM). An access method by which data records may be stored and retrieved using either the sequential access method or the direct access method. *See also*: **basic sequential access method; queued sequential access method; virtual sequential access method.**

indexed sequential access mode. An access mode in which data records may be stored and retrieved using either direct access mode or sequential access mode. *Note*: The records are actually stored in a sequential fashion, but an index is maintained to allow direct access. *Contrast with*: **direct access mode; sequential access mode.**

indexing segment. In a database, a segment that contains a pointer to another segment, called the indexed segment, containing data. *Syn*: **index pointer segment.**

index pointer segment. *See*: **indexing segment.**

index target segment. *See*: **indexed segment.**

indices. Plural form of index.

information. The meaning that humans assign to data by means of known conventions that are applied to the data. *See also*: **formatted information; narrative information.**

information interchange. The process of sending and receiving data in such a manner that the information content or meaning associated with the data is not altered during the transmission. *See also*: **data interchange.**

information retrieval. The techniques used to recover information from an organized body of knowledge. *See also*: **information storage.**

information separator (IS). Any control character used to delimit like units of data in a hierarchical arrangement of data. The name of the separator does not necessarily indicate the units of data that it separates. *Syn*: **separating character.** [ANDIPS/ISO]

information storage. The theory and techniques for the organization, storage, and searching of an organized body of knowledge. *Note*: Generally refers to a large body of data. *See also*: **information retrieval; information system.**

information storage and retrieval. *See*: **information storage; information retrieval.**

information storage and retrieval system. *See*: **information system.**

information system. A mechanism used for acquiring, filing, storing, and retrieving an organized body of knowledge. *Syn*: **information storage and retrieval system.** *See also*: **information storage and retrieval.**

inline recovery. Recovery performed by resuming a process at a point preceding the occurrence of a failure. *Contrast with*: **backward recovery; forward recovery.** [P610.12]

inorder traversal. The process of traversing a binary tree in a recursive fashion as follows: the left subtree is traversed in order, then the root is visited, then the right subtree is traversed in order. *Contrast with*: **postorder traversal; preorder traversal.** *Syn*: **symmetric traversal.** *See also*: **converse inorder traversal.**

input buffer. *See*: **buffer.**

input/output area. *See*: **buffer.**

insertion character. A character within a picture specification that represents a character that is inserted into the representation only under certain circumstances; for example, the value 1234, when represented using the picture specification 9,999 (the comma is the insertion character), is "1,234."

insertion sort. A sort in which each item in the set to be sorted is inserted into its proper position among those items already considered. *Syn*: **straight insertion sort.** *See also*: **address calculation sort; binary insertion sort; distribution counting sort; diminishing increment sort; linear sort; list insertion sort; radix insertion sort; tree insertion sort; two-way insertion sort.**

instantaneous access. *See*: **immediate access.**

instructional character. *See*: **control character.**

integer data. Numeric data used to represent whole numbers; that is, numeric values without fractional parts. For example, 0, +1, -1, +2, -2, ... *See also*: **fixed-point data; packed decimal data; unsigned packed decimal data; zoned decimal data.**

integrated data dictionary. A data dictionary that is functionally involved in data accesses, performing required checks for value limits and data types and disallowing illegal modifications to data elements within the system that is described.

integrity. The degree to which a system or component prevents unauthorized access to, or modification of computer programs or data. *See also*: **data integrity; database integrity.** [P610.12]

intelligent data model. A data model that describes the logic, controls, and constraints that should be applied whenever the data are accessed.

interblock gap. An area between two consecutive blocks. *Syn*: **block gap; record gap.**

interleaved array. In PL/1, an array whose name refers to non-contiguous storage.

internal label. A machine-readable label recorded on a data medium that provides information about the data recorded on the medium. *Contrast with*: **external label.** *See also*: **end-of-volume label; end of file; header label.**

internal merge sort. A merge sort performed within main storage. *See also*: **Batcher's parallel sort; list merge sort; two-way merge sort.** *Contrast with*: **external merge sort.**

internal model. A data model depicting entities within the conceptual schema of a database for a specific application. *Contrast with*: **external database model.**

internal node. *See*: **nonterminal node.**

internal record. A record within an internal view. *Syn*: **stored record.**

internal schema. (1) A description of the format and layout of the entire contents of a database including the data as well as overhead portions such as indices. *Note*: Written using data definition language. *Contrast with*: **conceptual schema; external schema.**
(2) A description of the data as it is physically stored in a database, including a description of the environment in which the database is to reside.

internal sort. A sort performed within main storage. *Syn*: **in-core sort.** *Contrast with*: **external sort.**

internal view. The format, layout, and contents of the entire data content and overhead content of a database, as described in an internal schema. *Note*: There may be many external views of a database, but only one internal view.

interpolation search. A searching technique in which, at each step of the search, an estimate is made of where the desired record is apt to be. *Syn*: **estimated entry search; external entry search.** *Contrast with*: **binary search; dichotomizing search; fibonacci search.**

intersection. A relational operator that combines two relations having the same degree and results in a relation containing all of the tuples that are in both of the original relations. *See also*: **difference; join; product; projection; selection; union.**

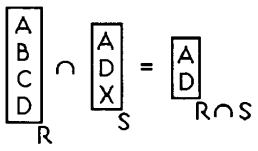

Fig 16
Intersection

invalid character. * *See*: **illegal character.**
* Deprecated.

inversion. The process of constructing an inverted list to be used to access a set of records.

inverted file. (1) A file whose elements may be retrieved by searching either the primary key or secondary key of each record. *Note*: An inverted file is distinguished from other files by the logical relationship and organization of items and records. In an inverted file, each value of each data item in the records appears exactly once, instead of once in each record. *See also*: **fully inverted file; partially inverted file; secondary index.**
(2) A file whose initial sequence has been reversed or whose contents may be searched in reverse order.

inverted list. (1) A list whose contents may be retrieved by searching either the primary key or the secondary key of each element.
(2) A technique for organizing records in which the primary keys for records that have equivalent values for a given secondary key are stored in a secondary index. *Contrast with*: **multilist.** *See also*: **inversion.**

irrational number. A real number that is not a rational number. *Contrast with*: **rational number.**

IS. Acronym for **information separator.**

ISAM. Acronym for **indexed sequential access method.**

ISP. Acronym for **information structure perspective.**

item. One member of a group; for example, a field in a record or a record in a file. *See also*: **data item.**

item condition. A disjunction of two or more atomic conditions such that the name of the data item is the same in each atomic condition. For example, "LASTNAME = 'JONES' or LASTNAME = 'SMITH' or LASTNAME = 'GREEN.'" *Note*: The disjunction may be implied, as in the example "LASTNAME = ('JONES','SMITH','GREEN'). *See also*: **query condition; record condition.**

join. A relational operator that combines two relations having a common attribute and which results in a relation containing all of the attributes from both of the original relations. *See also*: **intersection; difference; product; projection; selection; union.**

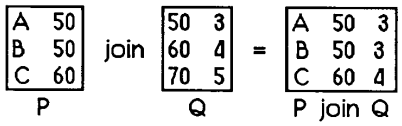

Fig 17
Join

join dependency. A type of dependency within a relation R, in which R is join dependent on $X, Y, ..., Z$ (subsets of attributes in R) if and only if R is equal to the join of its projections on $X, Y, ..., Z$. *See also*: **functional dependency.**

journal. A chronological record of the changes made to a set of data. *NOTE:* This record may be used as an audit trail to reconstruct a previous version of the data. *Syn*: **log.** [610.2]

key. (1) In data management, a data element or concatenation of data elements that identifies an item within a set of items. *Note*: Such a data element is also known as a key field. *See also*: **concatenated key; key value; primary key; secondary key; sort key.** *Syn*: **key field; sequence field.**
(2) In a relational data model, one or more attributes that, when taken together, identify the relation to which the attributes belong.
(3) In a tree, the portion of each node that identifies that node.

key compression. The elimination of data from the beginning and the end of a key in which these characters are not needed to distinguish the key from other keys in the set.

key field. *See*: **key.**

key folding function. A hash function in which the original key is split into two or more parts and some portion of their sum is returned as the hash value. For example, in the function below, the key is divided into three parts and the sum of the three parts is returned as the hash value.

Original key	Calculation	Hash value
96472135	964 + 721 + 35 = 1738	1738
90007810	900 + 078 + 10 = 988	988

key generation. The process of generating the key values for the items in a set according to some algorithm.

key range. A particular range of values of the keys found in some set of data. *Note*: Key ranges may be used to partition the set into subsets.

key sequence. Pertaining to a set of data that has been sequenced according to the value of some key.

key sorting. A sorting technique in which a table of sort keys and corresponding addresses that point to the items to be stored are manipulated instead of moving the items themselves. *See also*: **address table sorting.**

key transformation. In searching, the process of mapping a set of keys into a set of integers, using a hash function.

key transformation function. *See*: **hash function.**

key value. The contents of a key.

keyed access. *See*: **indexed access.**

knowledge base. A collection of interrelated information, facts, or statements. [P610.12]

label. One or more characters within or attached to a set of data, that identify or describe the data. *Syn*: **identifier.**

last-in, first-out (LIFO). (1) A technique for managing a set of items to which additions and deletions are to be made; items are appended to one end and retrieved from that same end. *See also*: **stack.**
(2) Pertaining to a system in which the next item to exit the system is the item that has been in the system for the shortest time. *Contrast with*: **first-in, first-out.** *Syn*: **first-in, last-out.**

layout character. *See*: **format effector character.**

leader. The blank section of magnetic tape at the beginning of a reel.

leading zero. A zero that precedes the first non-zero digit in a numeric representation; for example, the two zeros in "00324.6." *Contrast with*: **trailing zero.**

leaf. (1) A terminal node in a search tree.
(2) In a tree, a node that has no children.

least significant character. The character in the rightmost position in a character string. *Contrast with*: **most significant character** [1084].

least significant digit. The digit having the smallest effect on the value of a numeral; usually the right-most digit; for example, the 4 in 756.4. *Contrast with*: **most significant digit.**

left-threaded tree. A tree in which the left link field in each terminal node is made to point to its predecessor with respect to a particular order of traversal. *Contrast with*: **right-threaded tree.**

length. *See*: **block length; record length.**

library. *See*: **data library.**

LIFO. Acronym for **last-in, first-out.**

limit check. A consistency check that ensures that a certain item limit is not exceeded. For example, if a record can hold four transactions, a limit check will reveal an error situation if an attempt is made to add a fifth transaction to a record.

limited-domain data element. A data element whose domain is bounded. For example, a data element SEX with a domain of [M,F].

line-deletion character. A character within a line of terminal input specifying that it and all previous characters on the line are to be removed from the line; for example, if "*" is the line-deletion character in the string "ABCD*APPLE," the following would appear on the terminal: "APPLE." *See also*: **character-deletion character.**

linear array. A one-dimensional array.

linear data structure. A nonprimitive data structure that can represent data that is one-dimensional in nature. For example, a vector. *Contrast with*: **nonlinear data structure.**

linear linked list. *See*: **linked linear list.**

linear list. A list that preserves the relationship of adjacency between data items in the list.

linear probing. Open-address hashing in which collision resolution is handled by inserting an item that has a duplicate hash value into the next available position in the hash table. *Syn*: **consecutive spill method.** *Contrast with*: **quadratic probing; random probing; uniform probing.**

linear search. *See*: **sequential search.**

linear sort. (1) A insertion sort in which each item in the set to be sorted is inserted into the sorted set by scanning the sorted set sequentially to locate the proper place.
(2) A sort in which the items in the set to be sorted exist in a linear list. *Syn*: **straight line sort.**

link. (1) *See*: **pointer.**
(2) To establish a pointer; for example, to link two items in a hierarchy.
(3) In relation theory, a relationship between two or more entities or records.
(4) To append an item to a linked list. *See also*: **link field; push.**

link field. (1) A field in each item of a linked list, containing a pointer to the next or preceding item in the list. *Syn*: **chain field.**
(2) In a tree, that portion of each node that contains a pointer to other nodes in the tree.

linked linear list. A linear list in which each item contains a pointer to the next item in the list, making it unnecessary for the items to

be physically sequential. *Note*: the items are still logically adjacent. *Syn*: **linear linked list.**

linked list. A list in which each item contains a pointer to the next or preceding item in the list, making it unnecessary for the items to be physically sequential. *Note*: Unless the list is circular, the last item in the list contains a null link field. *Syn*: **chain; chained list; one-way chain; singly linked list.** *See also*: **circularly linked list; doubly linked list; linked linear list.**

list. (1) A set of data items, each of which has the same data definition. *See also*: **linear list; linked list; ordered list; queue; stack; unordered list.**
(2) To print or otherwise display a set of data items.
(3) * *See*: **linked list.**
* Deprecated.

list insertion sort. An insertion sort implemented using the list sorting technique. For example, a linear sort.

list merge sort. A merge sort implemented using the list sorting technique.

list processing. The manipulation of data that is or is going to be stored in list structures.

list sorting. A sorting technique in which the items to be sorted form a linked list and the links between the items in the list are manipulated in such a way that, in the final list, the items form a linked list in sorted order. *See also*: **address table sorting; key sorting.**

list structure. (1) A list, each item of which is either a single data item or a list structure itself.
(2) A data structure that contains one or more lists. *Syn*: **compound list.**

literal. Composed of characters, as in a literal variable name used to contain a customer's name.

load. To insert data values into a database that previously contained no data. *Syn*: **populate.** *See also*: **download; upload.**

loading factor. (1) The maximum amount of usable space in a physical block after accounting for block overhead.
(2) The ratio of the number of stored entities in a file to the maximum number of entries that can be stored in a unit of data medium.

lock. (1) To exclude users from updating data that is being updated by another user. *Note*: Depending on the implementation, locking may occur on a field, record or an entire file. *See also*: **deadlock; exclusive lock.**
(2) To exclude users from accessing data. *Syn*: **field-locking; file-locking; record-locking.**

locking. In code extension characters, having the characteristic that a change in interpretation applies to all coded representations following, or to all coded representations of a given class, until the next appropriate code extension character occurs. *Contrast with*: **nonlocking.**

locking shift character. A shift-out character that causes all characters that follow to be interpreted as members of a different character set from the original one until the shift-in character of the original character set is encountered. *Contrast with*: **nonlocking shift character.**

log. *See*: **journal.**

logarithmic search. *See*: **binary search.**

logical. (1) Pertaining to a view or description of data that does not depend on the characteristics of the computer system or the physical storage.
(2) Pertaining to the form of data organization, hardware or system that is processed by an application program; it may be different from the real (physical) form. *Contrast with*: **physical.**

logical child segment. (1) In a hierarchical database, a child segment in a logical database.
(2) A pointer segment that establishes a child/parent relationship between a physical segment and a logical parent segment. *See also*: **physical child segment.**

logical data. Data used to represent the result of some logical operation.

logical data model. A data model that represents the meaning of the data contained in a data structure. *Contrast with*: **physical data model.**

logical database. (1) A database as it is perceived by its users. *Syn*: **application view; logical view.**
(2) A database containing a collection of related segments that may reside in one or more physical databases. *Note*: A logical database is sometimes referred to as a logical view or application view of a physical database. *See also*: **logical segment; view integration.**
(3) A database containing a subset of the segments in a physical database. *Note*: The root segment in the logical database must be the root segment in the physical database. *Contrast with*: **physical database.**

logical file. A file independent of its physical environment. Portions of the same logical file may be located in different physical files, and several logical files or parts of logical files may be located in one physical file.

logical parent segment. (1) In a hierarchical database, a parent segment in a logical database. *See also*: **physical parent segment.**
(2) A segment that is pointed to by a logical child segment, establishing a parent/child relationship between the logical parent segment and some physical segment. *Note*: A logical parent segment may also be a physical parent segment.

logical record. A record independent of its physical environment. *Note*: Portions of the same logical record may be located in different physical records, and several logical records or parts of logical records may be located in one physical record.

logical schema. A schema that defines a data model.

logical segment. A segment in a logical database. *See also*: **logical child; logical parent; logical twin.**

logical structure. *See*: **data structure.**

logical twin segment. A twin segment in a logical database. *Contrast with*: **physical twin segment.**

logical view. *See*: **external schema; logical database.**

look up. To use a code-decode table or dictionary to obtain data values or other information. *See also*: **table look-up.**

look-up table. *See*: **code-decode table; dictionary.**

low order position. The rightmost position in a string; for example, the letter "E" in "APPLE" or the "5" in "965." *Contrast with*: **high order position.** *See also*: **least significant character; least significant digit.**

m:n relationship. * *See*: **many-to-many relationship.**
* Deprecated.

machine word. *See*: **word.**

machine-readable medium. A data medium that is machine-readable. *Syn*: **automated data medium.**

main file. *See*: **master file.**

major key. *See*: **primary key.**

many-to-many relationship. A relationship between two entities A and B such that any instance of A may be more associated with than one instance of B, and vice-versa. *Syn*: **m:n relationship.**

map. (1) To establish a correspondence between the elements of one set and the elements of another. *Syn*: **map over.**
(2) To establish a correspondence between the logical structure of a database and the physical structure of that database.

map over. *See*: **map.**

mark. A symbol or group of symbols that

indicates the beginning or end of a field, a word, an item of data, or a set of data such as a file, a record, or a block.

master file. An organized collection of records that is relatively permanent; for example, a file containing employee names, addresses, and salary information. *Syn*: **main file.** [610.2]

match. (1) A condition in which the values of corresponding components of two or more data items are equal. *See also*: **hit.**
(2) To compare two or more data items to determine whether their corresponding components are equal as in (1).

matrix. A two-dimensional array, conceptually arranged in rows and columns. *Note*: A matrix with m rows and n columns is said to be of size $m \times n$ (m-by-n). *See also*: **column-major order; row-major order; table.**

medium. *See*: **data medium; empty medium; machine-readable medium; virgin medium.**

member. In data management, a subunit contained in a partitioned data set.

merge. To combine the items of two or more sets, all in the same order, into one set in that order. *See also*: **balanced merge; bitonic merge; coalesce; collate; merge sort; order-by-merging; unbalanced merge.**

merge exchange sort. *See*: **Batcher's parallel sort.**

merge search. A sequential search in which the set of search arguments is ordered in the same sequence as the set to be searched; the set is searched sequentially, using the first search argument, until an equal or greater search key is found, the former case signifying a successful search, the latter, an unsuccessful search; the search for the next search argument begins where the last search left off.

merge sort. A sort in which the set to be sorted is divided into subsets, the items in each subset are sorted, and the sorted subsets are merged. *Syn*: **merging sort.** *See also*: **external merge sort; internal merge sort.**

merging sort. *See*: **merge sort.**

metadata. Data that describes other data; for example, a data dictionary contains a collection of metadata.

mid-square function. In hashing, a hash function that returns the middle digits of the square of the original key. For example, in the function below, the middle three digits are returned. *Syn*: **middle-square function.**

Original key	Calculation	Hash Value
2964	2964 x 2964 = 8,785,296	852
1119	1119 x 1119 = 110,781	78

middle-square function. *See*: **mid-square function.**

minor key. *See*: **secondary key.**

minus. *See*: **difference.**

modify. (1) To change the contents of a database.
(2) To change the logical structure of a database. *See also*: **alter.**

molecular data element. *See*: **composite data element.**

most significant character. The character in the leftmost position in a character string. *Contrast with*: **least significant character.** [1084]

most significant digit. The digit having the greatest effect on the value of a numeral; usually the leftmost digit; for example, the 7 in 756.4. *Contrast with*: **least significant digit.**

multifield key. *See*: **concatenated key.**

multilist. A technique for organizing records in which records that have equivalent values for a given secondary key form a

linked list. *Contrast with*: **inverted list (2)**. *Syn*: **multiple threaded list.**

Student	Name	Homeroom	Link
1	MARY	25	4
2	JOE	27	15
3	JOHN	10	6
4	ANNE	25	5
5	SUSAN	25	-
6	KIM	10	21
7	BOB	26	16
.	.	.	.

Fig 18
Multilist

multiple list insertion sort. *See*: **address calculation sort.**

multiple precision. Pertaining to the use of two or more computer words to represent a number in order to preserve or gain precision. *Contrast with*: **single precision.** *See also*: **double precision; triple precision.** [1084]

multiple threaded list. *See*: **multilist.**

multiplication transformation function. In hashing, a hash function that returns the original key multiplied by some value. For example, in the function below, the original key is multiplied by the length of the record in which it is found. *See also*: **mid-square function.**

Original Record	Calculation	Hash Value
35 Bob White	35 x 13 = 448	448
41 Richard Doe	41 x 17 = 697	697

multivalued dependency. A type of dependency among three attributes A, B, and C in relation R, in which B is multivalued dependent on A if, and only if, the set of values of B that match a given pair of values for A and C depends only on the value for A and is independent of the value for C. *See also*: **fourth normal form.**

multiway merge sort. A merge sort in which the set to be sorted is divided into two or more ordered subsets that are merged by comparing the smallest items of each subset, outputting the smallest of those, then repeating the process. *See also*: **two-way merge sort.**

multiway radix trie search. A radix trie search using a trie of order greater than 2, in which more than one digit is considered on each branch. *See also*: **binary radix trie search.**

multiway tree. A tree of order greater than 2.

***n*-ary relation.** A relation with n attributes in each tuple.

***n*-ary tree.** A tree of order n; for example, an 8-ary tree. *See also*: **binary tree; multiway tree; octary tree; quadary tree.**

***n*-*m* tree.** A tree in which each node has at least n but no more than m subtrees; for example, 2-4 tree. *Note*: A 2-4 tree is sometimes written as 2-3-4 tree.

***n*-tuple.** (1) An ordered set of values $(x_1, x_2, ..., x_n)$.
(2) In a relational data model, a tuple.

NAK. Acronym for the **negative acknowledge character.**

name. An alphanumeric term that identifies a data item such as a field, record, or file.

narrative information. Information that is presented according to the syntactic order of a natural language. *Contrast with*: **formatted information.**

national character. Deprecated term for the characters #, @, and $.

native data type. A data type that is built into a software or hardware system.

natural number. One of the positive numbers {0,1,2,...}.

natural two-way merge sort. A two-way merge sort in which the set to be sorted is repeatedly divided into two ordered subsets and

merged, taking advantage of runs which occur naturally in the input set. *Contrast with*: **straight two-way merge sort.**

negative acknowledge character (NAK). A transmission control character transmitted by a station as a negative response to the station with which the connection has been set up. [ANDIPS/ISO]

net structure. *See*: **network structure.**

network. (1) A data structure in which components are allowed to have more than one superordinate component. *See also*: **hierarchy; graph.**
(2) A graph in which the edges connecting the nodes are assigned weights representing some characteristic, such as cost or quantity, related to the edge.

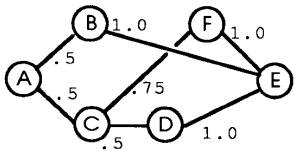

Fig 19
Network

network database. A database in which data are organized into segments which represent nodes within a network. *Contrast with*: **hierarchical database; relational database.**

network model. A data model in which entities are represented as nodes within a modified tree structure that permits all but the root to have multiple parents. *Note*: The network model was originally proposed as the CODASYL model by the Conference on Data Systems Languages (CODASYL) and described in their 1968 and 1971 publications.

network structure. A collection of entities that are organized in a network fashion. *Contrast with*: **hierarchical structure.** *Syn*: **net structure.**

new-line character (NL). *See*: **carriage return character.**

NL. Acronym for the **new-line character.**

node. In a tree, an element that is used to contain information that describes some object; for which there is at least one key used to identify the node. *Note*: Nodes are connected to each other by link fields to form the tree. *Syn*: **vertex.** *See also*: **child node; nonterminal node; parent node; root node; terminal node.**

nonprimitive data structure. A structured set of primitive data structures. Structures may be linear, as in a vector, or nonlinear as in a tree. *See also*: **linear data structure; nonlinear data structure.** *Syn*: **complex data structure.** *Contrast with*: **primitive data structure.**

nonsignificant code. A code that identifies a particular item but does not yield further information about the properties or classification of the item. *Contrast with*: **significant code.**

nonlinear data structure. A nonprimitive data structure that can represent data that is multidimensional in nature. For example, a tree. *Contrast with*: **linear data structure.**

nonlocking. In code extension characters, having the characteristic that a change in interpretation applies only to a specified number of the coded representations following, commonly only one. *Contrast with*: **locking.**

nonlocking shift character. A shift-out character that causes the character following it to be interpreted as a member of a different character set from the original set. *Contrast with*: **locking shift character.**

nonprime attribute. An attribute that is not part of any candidate key of a relation. *Contrast with*: **prime attribute.**

nonterminal node. In a tree, a node that can have one or more subtrees. *Syn*: **branch node; internal node.** *Contrast with*: **terminal node.** *See also*: **root node.**

nontransitive dependency. A type of dependency among attributes in a relation, in

which a nonprime attribute A is said to be nontransitively dependent on another attribute B if and only if A is dependent on B, and there is another attribute C that is functionally dependent on B but does not functionally determine A. *Contrast with*: **transitive dependency**.

normal form. The form of a data structure, relation, or database that has been reduced to a simpler, more stable form than it was in its unnormalized form. *See also*: **Boyce/Codd normal form; first normal form; fourth normal form; projection/join normal form; second normal form; third normal form.**

normalization. (1) The process of decomposing and restructuring a complex data structure in order to reduce the structure to a simpler, more stable form. *Note*: Such a data structure is said to be in "normal form."
(2) The process of reducing a relation to its simplest form such that each attribute is derived from a single domain consisting of nondecomposable values.

normalize. (1) In database design, to reduce a data structure, relation, or database to a simpler, more stable form. *Syn*: **standardize.** *See also*: **normal form; normalized form.**
(2) To alter or position data into a standard format, as in justification of text.
(3) To adjust the exponent and mantissa of floating-point data such that the mantissa lies in a standard range. *See*: **normalized form.**

normalized form. (1) In database design, the form assumed by data that have been normalized. *See also*: **normal form.** *Contrast with*: **unnormalized form.**
(2) The form taken by a floating-point representation when the fixed-point part lies within some standard range, so chosen that any given real number can be represented by a unique pair of numerals. Examples below illustrate real data and their corresponding normalized form such that the fixed-point portion is in the form x.xxx.

$.123 * 10^4 = 1.23 * 10^3$
$.999 * 10^{-1} = 9.99 * 10^{-2}$

Syn: **standard data.**

normalized relation. *Contrast with*: **unnormalized relation.** *See*: **normalize; relation.**

NUL. Abbreviation for the **null character**.

null character (NUL). A control character that is used to accomplish media-fill or time-fill, and that may be inserted into or removed from, a sequence of characters without affecting the meaning of the sequence; however, the control of equipment or the format may be affected by this character. *See also*: **space character.** [ANDIPS/ISO]

null data. Data for which space is allocated but for which no value currently exists.

null pointer. A pointer that is empty; that is, a pointer that does not point to anything.

null string. A string containing no entries. *Note*: It is said that a null string has length zero.

null tree. A tree that has exactly one root and one descendant node.

numeric. Pertaining to data that can be expressed using only numbers and mathematical symbols, in contrast to characters or other special signs or symbols. *Syn*: **numerical.** *See also*: **arithmetic; numeric data; pure numeric.**

numeric bit data. *See*: **binary picture data.**

numeric character. *See*: **digit.**

numeric character data. *See*: **decimal picture data.**

numeric character set. A character set that contains digits and may contain control characters, special characters, and the space character, but not letters.

numeric code. A code that uses numerals to represent data. [1084]

numeric data. Data used to represent numbers. *See also*: **binary data; complex data; integer data; packed data; real data.**

numeric representation. A discrete representation of data by numerals.

numeric shift. A control for selecting the numeric character set on an alphanumeric keyboard or printer. *Contrast with*: **alphabetic shift.** *See also*: **shift character.**

numerical. *See*: **numeric.**

occurrence. An individual instance of an entity, record, or item, containing a specific set of values for its constituent parts.

octary tree. A tree of order 8. *Note*: Such a tree is typically used to store three-dimensional data. *Syn*: **octonary tree; octtree.**

octet. A group of eight adjacent digits operated upon as a unit. [1084]

octonary tree. *See*: **octary tree.**

octtree. *See*: **octary tree.**

odd-even sort. *See*: **Batcher's parallel sort.**

one-way chain. *See*: **linked list.**

open-address hashing. Hashing in which collision resolution is handled by inserting an item that has a duplicate hash value into another available position in the hash table. *See also*: **double hashing; linear probing; random probing; uniform probing.** *Contrast with*: **separate chaining.**

operational character. *See*: **control character.**

order. (1) To place items in an arrangement in accordance with a specified set of rules. *Note*: The arrangement need not be linear. *See also*: **sort (1).**
(2) The result of an arrangement as in (1).
(3) In a tree, the maximum number of subtrees of any node.
(4) * *See*: **sequence (1).**
* Deprecated.

order by merging. To order the items of a set by splitting the set into subsets, ordering the subsets, and merging the subsets. *See also*: **sequence by merging; sort by merging.**

ordered list. A list in which the data items are arranged in some specific order, either physically or logically by some key. *Contrast with*: **unordered list.**

ordered tree. A tree in which the left-to-right order of the subtrees of a given node is significant. *Contrast with*: **unordered tree.**

ordering bias. The manner and degree by which the order of a set of items departs from the order of a randomly distributed set of items. The ordering bias of a set is inversely proportional to the effort required to sort the set.

OSAM. Acronym for **overflow sequential access method.**

oscillating sort. An external merge sort in which sorts and merges are performed alternately; that is, the first two subsets are sorted and merged, the next subset is sorted and merged with the previously merged subsets, and so on, until all subsets are sorted and merged.

output buffer. *See*: **buffer.**

overflow area. A physical location in which data are placed when there is no available space in the primary data area. Overflow areas may be allocated within stored record, physical blocks, disk tracks, or disk cylinders.

overflow sequential access method (OSAM). An access method for handling data overflow from ISAM.

pack. To store data in a compact form in a storage medium, using known characteristics of the data and medium in such a way as to permit recovery of the data. *See also*: **packed data.** *Contrast with*: **unpack.**

packed array. An array in which all data elements in the set have non-trivial values. *Syn*: **dense list.**

packed binary data. Binary data stored in a compact form in a storage medium, using known characteristics of the data and the medium to permit recovery of the data.

packed data. Data stored in a compact form in a storage medium, using known characteristics of the data and the medium to permit recovery of the data. *See also*: **packed binary data; packed decimal data.**

packed decimal data. Integer data stored in a compact form in a storage medium, using known characteristics of the data and the medium to permit recovery of the data. In the most common implementation, each decimal digit is represented in binary, occupying four bits, and the right-most decimal digit is followed by a four-bit sign digit (hexadecimal A,C,E, or F for positive; B or D for negative). *Syn*: **signed packed decimal data.** *See also*: **unsigned packed decimal data.**

decimal	275_{10}
packed decimal	$0010\ 0111\ 0101\ 1111_2 = 275F_{16}$
decimal	-91_{10}
packed decimal	$0000\ 1001\ 0001\ 1011_2 = 091B_{16}$

pad. To fill an item such as a record or block with one or more filler characters in order to satisfy some prescribed condition. For example, in order to right justify a seven-character string in a ten-position field, three blank characters are used to **pad** the data. *See also*: **character fill; zero fill.**

page. (1) A fixed-length segment of data or of a computer program treated as a unit in storage allocation. [P610.12]
(2) In a virtual storage system, a fixed-length segment of data or of a computer program that has a virtual address and is transferred as a unit between main and auxiliary storage. [P610.12]

page eject character. *See*: **form feed character.**

paper throw character. *See*: **form feed character.**

parent node. In a tree, a node having a given node as a child node. *Syn*: **father.** *Contrast with*: **child node; dependent node.** *See also*: **descendant node; logical parent; physical parent.**

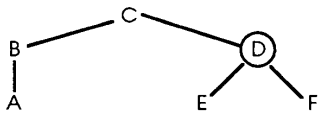

Fig 20
Node D Is the Parent Node for Node E

parent segment. In a hierarchical database, a segment that has one or more dependent segments, called child segments, below it in a hierarchy.

partially inverted file. A file that has been inverted on some of its secondary keys. *Contrast with*: **fully inverted file.**

partition exchange sort. *See*: **quicksort.**

partition sort. *See*: **quicksort.**

partitioned access. The process of storing and retrieving data from storage in such a way that the data is divided into subunits, called members, and the data may be processed as a whole or member by member. *Note*: The directory used to retrieve each member is stored along with the data. *See also*: **basic partitioned access method; partitioned data set.**

partitioned data set (PDS). A file that is divided into subunits, called members, each of which may be processed individually. *Contrast with*: **indexed file; sequential file.**

passive data dictionary. A data dictionary that is only a repository for data definitions. *Note*: No active measures are taken to ensure that the data dictionary is consistent with the data items actually used in the system. *Syn*: **stand-alone data dictionary.** *Contrast with*: **active data dictionary.**

path. (1) In a hierarchical database, a sequence of segments encountered in traversing from the root segment to an individual dependent segment.
(2) With respect to a network or graph, some sequence of nodes such that each successive node is connected to its predecessor by an edge. *See also*: **simple path.**

PDS. Acronym for **partitioned data set.**

permutation. An ordered sequence of a given number of items chosen from a set. *Contrast with*: **combination.**

PHR. *See*: **physical record.**

physical. Pertaining to the representation and

storage of data on a data medium such as magnetic disk, or to characteristics of the data such as the length of data elements or records. *Contrast with*: **logical.**

physical child segment. In a hierarchical database, a child segment in a physical database. *See also*: **logical child segment.**

physical data model. A data model that represents the implementation of the data contained in a data structure. *Contrast with*: **logical data model.**

physical database. (1) A database as it is actually stored.
(2) A database containing a collection of related segments or records that are physically stored together. *Note*: Segments within a physical database are known as physical segments. *Contrast with*: **logical database.**

physical parent segment. In a hierarchical database, a parent segment in a physical database. *See also*: **logical parent segment.**

physical record (PHR, PR). (1) A record whose characteristics depend on the manner or form in which it is stored, retained, or moved. *Note*: A physical record may consist of all or part of a logical record or several physical records.
(2) That which is accessed by a single read or write operation.

physical segment. In a hierarchical database, the smallest unit of accessible data. *See also*: **physical child segment; physical parent segment; physical twin segment.**

physical sequential access. *See*: **sequential access.**

physical structure. The representation and storage of a database on a data medium. *See also*: **conceptual schema; reorganization.**

physical twin segment. In a hierarchical database, a twin segment in a physical database. *Contrast with*: **logical twin segment.**

physical volume. *See*: **volume.**

picture data. Data that are associated with a picture specification. *Syn*: **pictured data.** *See also*: **binary picture data; decimal picture data.**

picture specification. A character-by-character description of the composition and characteristics of the representation of some data item; for example, the picture S99V999 (S = sign character; 9 = decimal digit character; V = radix point character) may be used to describe the following items, resulting in the picture data as indicated:

value	picture data
.06	+00.060
-10.342	-10.342
3	+03.000

pictured data. *See*: **picture data.**

pocket sort. *See*: **distribution sort.**

pointer. A data item that specifies the location of another data item; for example, a data item that specifies the address of the next employee record to be processed. *Syn*: **link.** *See also*: **pointer segment; stack pointer.** [P610.12]

pointer data. Data used to represent the addresses of other data items.

pointer optimization. A database reorganization technique in which database access is made more efficient by reestablishing the pointers within the database so that fewer pointers are needed to represent the database structure.

pointer segment. A segment in a database that establishes a parent/child relationship between segments. *Note*: The segment contains only a pointer to the physical child segment for its parent segment.

polyphase merge sort. An unbalanced merge sort in which the distribution of the sorted subsets is based on a polynomial series such as the Fibonacci series. *See also*: **cascade merge sort.**

pop. *See*: **pull.**

populate. *See*: **load.**

population. The number of records in a file or database.

postorder traversal. The process of traversing a binary tree in a recursive fashion as follows: the left subtree is traversed, then the right tree is traversed, then the root is visited. *Contrast with*: **inorder traversal; preorder traversal.** *Syn*: **endorder traversal.** *See also*: **converse postorder traversal.**

PR. *See*: **physical record.**

precision. The degree of exactness or discrimination with which a quantity is stated; for example, a precision of 2 decimal places versus a precision of 5 decimal places. *See also*: **double precision; multiple precision; single precision; triple precision.** [1084]

preorder traversal. The process of traversing a binary tree in a recursive fashion as follows: the root is visited, then the left subtree is traversed, then the right subtree is traversed. *Contrast with*: **inorder traversal; postorder traversal.** *See also*: **converse preorder traversal.**

primary data element. A data element within a record that represents the subject of that record; for example, the data element "name" in a record containing "name," "city of birth," and "data of birth." *Contrast with*: **attribute data element.**

primary key. (1) In sorting and searching, the key that is given the highest priority within a group of related keys. For example, after sorting, the values in the primary key will be in the given order, independent of the values of the other fields. *Syn*: **major key; prime key.** *Contrast with*: **secondary key.**
(2) In a relation, a specific minimal set of attributes that functionally determines all other attributes in the relation, and thus uniquely differentiates one entity from another. *Note*: More than one set of attributes with this property may exist. Each such set is known as a candidate key, but only one is chosen as the primary key. *See also*: **alternate key; candidate key.**

primary space allocation. The amount of space that is reserved for a particular file when it is initially defined. *Contrast with*: **secondary space allocation.**

prime attribute. An attribute that forms all or part of the primary key of a relation. *Contrast with*: **nonprime attribute.**

prime key. *See*: **primary key.**

primitive data structure. A data structure that can be directly operated upon by machine-level instructions. Examples include integer, real, character, logical, and pointer. *Contrast with*: **nonprimitive data structure.**

print control character. A control character for print operations such as line spacing, page ejection, or carriage return.

print data set. A data set in which data that is to be printed are stored.

print record. A record in a print data set.

priority queue. A list to which items may be appended to or retrieved from any position, depending on some property of the item being added or removed. *Note*: This data structure is misnamed in that it contradicts the definition of queue.

probing. *See*: **linear probing; quadratic probing; random probing; uniform probing.**

product. A relational operator that builds a relation from two specified relations consisting of all possible concatenated pairs of tuples, one from each of the two original relations. *See also*: **difference; intersection; join; projection; selection; union.**

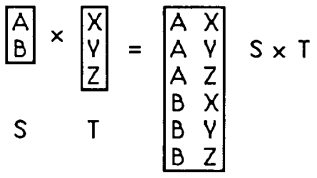

Fig 21
Product

program data set. A data set in which user programs are stored.

project. *See*: **projection.**

projection. A relational operator that extracts specified attributes from a relation and results in a relation containing only those attributes. *See also*: **difference; intersection; join; product; selection; union.** *Syn*: **project.**

Name	Homeroom
Mary	26A
Joe	43
Harry	27
Michael	25
Susan	25
Mickey	41

Fig 22
Projection of Relation *Students* in Fig 11 on Attributes NAME and HOMEROOM

projection/join normal form (PJ/NF or 5NF). *See*: **fifth normal form.**

propagation sort. *See*: **bubble sort.**

protection character. A character used to replace a suppressed zero in order to avoid error or false statements; for example, in the string "$********50.03" the asterisk is the protection character.

pull. To retrieve data from a stack. *Contrast with*: **push.** *Syn*: **pop.**

pure alphabetic. Pertaining to data that contains only the letters of the alphabet (AaBbCcDdEeFfGgHh...). *Contrast with*: **pure alphanumeric; pure numeric.**

pure alphanumeric. Pertaining to data that contains only the letters of the alphabet (AaBbCcDdEeFfGgHh...) and the numerals (1234567890). *Contrast with*: **pure alphabetic; pure numeric.**

pure numeric. Pertaining to data that contains only the numerals (1234567890). *Contrast with*: **pure alphabetic; pure alphanumeric.**

push. To append data onto a stack. *Contrast with*: **pull.**

push-down list. *See*: **stack.**

push-down stack. *See*: **stack.**

push-down storage. *See*: **stack.**

push-up list. *See*: **queue.**

push-up storage. *See*: **queue.**

put. To place an item into a set of items as in inserting a record into a file, or in representing a numerical value as a series of decimal digits. *Contrast with*: **get.**

QISAM. Acronym for **queued indexed sequential access method.**

QSAM. Acronym for **queued sequential access method.**

quadary tree. A tree of order 4. *Note*: Such a tree is usually used to store two-dimensional data. *Syn*: **quaternary tree; quadtree.**

quadratic probing. Open-address hashing in which collision resolution is handled by selecting positions at quadratically increasing increments from the original position in the hash table until an available position is found. *Contrast with*: **linear probing; random probing; uniform probing.**

quadratic selection sort. A tree selection sort in which the items in the set to be sorted are treated as nodes on a 4-ary tree.

quadtree. *See*: **quadary tree.**

qualification condition. In a query, a boolean condition that specifies which items in a database are to be accessed; that is, the qualification condition must be true for an item to be accessed by the query. *See also*: **atomic condition; item condition; query condition; record condition.**

qualified name. A name used to identify a component of a structure given by a sequence of names connected by periods; for example, in the following structure, the

qualified name STUDENT(5).COURSE(1).INSTRUCTOR identifies the instructor for the first course taken by the fifth student.

```
01 STUDENT(100),
   02 STUDENT_NUMBER        CHAR(5),
   02 COURSES(10),
      03 COURSE_NAME        CHAR(20),
      03 INSTRUCTOR         CHAR(20),
      03 GRADE              CHAR(2)
```

Fig 23
Qualified Name

quantitative data element. A data element containing numerical values that indicate quantity or amount.

quartet. A group of four adjacent digits operated upon as a unit. *Syn*: **four-bit byte.** [1084]

quaternary tree. *See*: **quadary tree.**

query. A request to access information stored in a database; for example, "Print the names of all personnel with salary > 9000 and sex = F." *Note*: A query consists of an operation (Print) and a qualification condition (salary > 9000 and sex = F). *See also*: **query language.**

query condition. A conjunction of two or more record conditions; for example:
(LASTNAME = JONES and SEX = F) or (LASTNAME = GREEN and SEX = M).

query language. A language used to access information stored in a database. *Syn*: **end-user language; search language.** *See also*: **query; relational language; report writer.** [P610.12]

queue. (1) A list in which items are appended to the last position in the list and retrieved from the first position in the list. That is, the next item to be retrieved is the item that has been in the list for the longest time. *Syn*: **push-up list; push-up storage.** *Contrast with*: **stack.** *See also*: **double-ended queue; priority queue.**
(2) A line formed by items waiting for service in a system in which the next item to exit the line is the item that has been in the line for the longest time.
(3) To arrange in, or to form a queue as in (1).

queued access method. An access method in which the transfer of data is synchronized between the processing unit and the storage device through the use of queues containing data waiting to be processed. *See also*: **queued indexed sequential access method; queued sequential access method.** *Contrast with*: **basic access method; direct access method.**

queued indexed sequential access method (QISAM). A variation of the queued access method that allows indexed sequential access to the data. *See also*: **basic indexed sequential access method.**

queued sequential access method (QSAM). A variation of the queued access method that allows sequential access to the data. *See also*: **basic sequential access method.**

quicksort. An exchange sort in which the set of items to be sorted is divided into two subsets such that all items in one subset precede all items in the other subset according to the sort criteria, the two subsets are similarly partitioned, and the process continues until all items are in the correct order. *Syn*: **partition exchange sort; partition sort.**

quintet. A group of five adjacent digits operated upon as a unit. *Syn*: **five-bit byte.** [1084]

quoted string. A character string that is enclosed by quotation marks or apostrophes. For example, "This is a quoted string."

radix exchange sort. A radix sort in which items are compared and, if necessary, exchanged in multiple passes, using successive digits within the numeric representation of the sort key, starting with the most significant digit. *Syn*: **divide-and-conquer sort.**

radix insertion sort. A radix sort in which each item is inserted into its proper position in the sorted set according to the digital properties of the numerical representation of the sort keys.

radix list sort. A radix sort implemented using the list sorting technique.

radix point character. A character within a picture specification that represents the radix point. *Syn*: **virtual point picture character.**

radix search. A searching technique that takes advantage of the digital properties of the numerical representation of the search keys. *See also*: **binary radix trie search; digital tree search; multiway radix trie search; radix trie search.** *Contrast with*: **radix sort.**

radix sort. A sort that takes advantage of the digital properties of the numerical representation of the sort keys; for example, sorting on keys with base 10 representation by first sorting on the hundreds place, then the tens place, then the ones place. *See also*: **digital sort; radix exchange sort; radix insertion sort; radix list sort; straight radix sort.** *Contrast with*: **radix search.**

radix transformation function. In hashing, a hash function the result of which is the original key in a different numerical base from its original base. For example, in the function below, the original key (assumed to be in base 10) is expressed in base 16.

Original key	Calculation	Hash value
72	$72_{10} = 48_{16}$	48
157	$157_{10} = 9D_{16}$	9D

radix trie search. A radix search in which the items in the set to be searched are placed in a trie. *Note:* The trie is traversed taking branches according to the search argument until a terminal node is encountered, and if the search is successful, the external node is equal to the search argument. *See also*: **binary radix trie search; multiway radix trie search.**

random access. (1) An access mode in which specific logical records are obtained from or placed into a file in a nonsequential manner. *Contrast with*: **direct access; sequential access.**
(2) * *See*: direct access.
* Deprecated.

random access method. * *See*: **direct access method.**
* Deprecated.

random number sequence. A sequence of numbers in which no number can be predicted from knowledge of its predecessors.

random probing. Open-address hashing in which collision resolution is handled by randomly selecting positions in the hash table until an available position is found. *Contrast with*: **linear probing; quadratic probing; uniform probing.**

random-ordered list. *See*: **unordered list.**

randomizing. *See*: **hashing.**

range check. A consistency check that ensures that an item of data falls between preestablished maximum and minimum values.

rational number. A real number that can be expressed as a fraction x/y where x and y are integers and y is not equal to zero. *Contrast with*: **irrational number.**

raw data. Data that has not been processed or reduced from its original form.

read. To access data from a storage device or data medium. *Contrast with*: **write.** *See also*: **delete; dirty read; retrieve; update.** [P610.12]

read-back check. *See*: **echo check.**

read-only access. A type of access to data in which the data may be read but not changed or deleted. *Contrast with*: **read/write access.** *See also*: **delete access; update access; write access.** *Syn*: **fixed.**

read/write access. A type of access to data in which the data may be both retrieved, changed, and stored. *Contrast with*: **read-only access.** *See also*: **delete access; update access; write access.**

real data. Data used to represent real numbers. *See also*: **binary coded decimal real data; floating-point real data.**

real fixed binary data. *See*: **fixed-point binary data.**

real fixed decimal data. *See*: **fixed-point real data.**

real float binary data. *See*: **floating-point data.**

real float decimal data. *See*: **floating-point data.**

real number. A member of the set of all positive and negative numbers, including integers, zero, mixed, fractional, rational, and irrational numbers. [1084]

realm. *See*: area.

record. A set of data items, called fields, treated as a unit. For example, in stock control, the data for each invoice could constitute one record. *See also*: **database record; entity.** *Syn*: **data record.** [P610.12]

record condition. A conjunction of two or more item conditions such that the name of the data item in each condition is distinct. For example, "LASTNAME = 'JONES' and SEX = 'FEMALE.'" *See also*: **query condition.**

record gap. * *See*: **interblock gap.**
* Deprecated.

record layout. The arrangement and structure of data in a record.

record length. The number of words or characters in a record.

record length type. The category to which a record belongs by virtue of having fixed or variable length.

record segmentation. The allocation of individual data items in a record to separate physical storage areas or to different physical devices.

record type. The category to which a record belongs by virtue its format, content, or characteristics.

record-locking. *See*: **lock.**

recovery. The restoration of a system, computer program, database, or other system resource to a prior state following a failure or externally caused disaster; for example, the restoration of a database to a point at which processing can be resumed following a system failure. *See also*: **backword recovery; forward recovery; inline recovery; rollback; rollforward.** [P610.12]

recursive data structure. A data structure that is defined in terms of itself.

recursively defined sequence. A sequence in which each item after the first is determined using a given operation for which one or more of the operands include one or more of the preceding items.

redefinition. (1) The process of changing a database schema by adding, removing, or renaming attributes or relations.
(2) In a relation, the process of changing the data type or size of an attribute, or altering the characteristics of a domain.

reformatting. *See*: **reorganization.**

rehashing. *See*: **collision resolution.**

relation. In a relational data model or relational database, a set of tuples, each of which has the same attributes. *Note*: Often thought of as a table of data. *See also*: **relation scheme.**

relation schema. The set of all attribute names for a relation.

relational algebra. An algebra that includes a set of relational operators, such as join and projection, to manipulate relations and the axioms of those operators.

relational data model. (1) A data model whose pattern or organization is based on a set of relations, each of which consists of an unordered set of tuples.
(2) A data model that provides for the expression of relationships among data elements as formal mathematical relations.

relational database. A database in which data are organized into one or more relations

that may be manipulated using a relational algebra. *Contrast with*: **hierarchical database; network database.**

relational database model. An external data model that represents a relational database.

relational database schema. A collection of relation schemas that define the structural properties of a relational database.

relational file. (1) A file, consisting of tuples, in which all data items are associated via the same relationship. *Note:* Also called a flat file.
(2) Any file resulting from relational algebra.

relational language. A query language that may be used to access and retrieve data from a relational database.

relational model. *See*: **relational data model; relational database model.**

relational operator. An operator that performs an operation on relations; for example, the join or projection operators. *See also*: **relational algebra.**

relationally complete. Pertaining to a query language or system that can be used to form expressions from a relational algebra.

relationship. A directed connection between two or more data items or attributes.

reorder. * *See*: **order.**
* Deprecated.

reorganization. (1) The process of rearranging the contents of a database so that space allocation is minimized and efficiency is maximized. Techniques include pointer optimization and garbage collection. *Syn*: **restructuring.** *See also*: **concurrent reorganization.**
(2) The process of rearranging the logical schema or physical structure of a database. *Syn*: **reformatting.**

repeated selection sort. A selection sort in which the set of items to be sorted is divided into subsets; one item that fits specified criteria is selected from each subset, forming a second-level subset; a selection sort is then applied to this second-level subset; the selected item is appended to the sorted set and is replaced in the second-level subset by the next eligible item in the original subset; and the process is repeated until all items are in the sorted set. *See also*: **tournament sort.**

repeating field. A field within a record that may have multiple occurrences within a record; for example, the data element "Student Name" may have up to 30 occurrences within the following record structure:

01	Course Name	20 characters
01	Instructor Name	25 characters
01	Students (30)	
	02 Student Name	25 characters
	02 Student Number	9 characters

Fig 24
Repeating Field

repeating group. A collection of data elements that may have multiple occurrences within a record; for example, the data elements representing the name and age of each dependent within an employee record.

report writer. A query language that can produce formatted reports using data from a database or other files.

reproduce. *See*: **duplicate.**

restore. To recover the state of a system, computer program, or database to a specific point. *See also*: **rollback; rollforward.**

restructuring. *See*: **reorganization.**

retrieve. To move data out of a storage device or data medium. *Contrast with*: **store (2).** *See also*: **read.**

right-threaded tree. A threaded tree in which the right link field in each terminal node is made to point to its successors with respect to a particular order of traversal. *Contrast with*: **left-threaded tree.**

ring. *See*: **circularly-linked list.**

rollback. Backward recovery of a database in which recently applied changes to the current version of a database are reversed. *Note*: A journal or checkpoint file is used to determine which changes must be reversed. *Syn*: **backout**. *Contrast with*: **rollforward**.

rollforward. Forward recovery of a database in which all or part of a database is restored using data from a backup or snapshot of the database. Changes since the backup are reapplied to the database to restore it to some recently existing state. *Contrast with*: **rollback**.

root. *See*: **root node**.

root node. In a tree, the single node that is not a member of any subtree. *Note*: All other nodes are descendent nodes of the root node. *Syn*: **root**. *See also*: **nonterminal node**; **terminal node**.

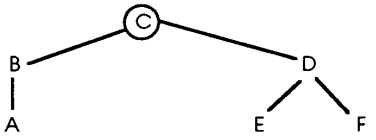

Fig 25
Node C Is the Root Node

root segment. A segment that is the root node in a database. *See also*: **database record; parent; path.** *Contrast with*: **child segment; dependent segment.**

rooted tree. *See*: **tree**.

round. To delete or omit one or more of the least significant digits in a representation of a number and to adjust the remaining digits according to some specified rule. *See also*: **round down; round off; round up**. *Contrast with*: **truncate**.

round down. To round, adjusting the part of the numeral that is retained by subtracting one from the least-significant of its digits, executing any necessary borrows if and only if one or more non-zero digits have been deleted; for example, the numbers 36.5667 and 105.401, when rounded down to 2 decimal places, become 36.56 and 105.40, respectively. *Note*: Rounding down is a form of truncation.

round off. (1) To round, adjusting the part of the numeral that is retained by rounding down any digit less than 5, rounding up any digit greater than 5, and rounding 5 up or down to the even digit. For example, 5.5 would be rounded off to 6, and 4.5 rounds off to 4.
(2) To round, adjusting the part of the numeral that is retained by rounding down any digit less than 5, rounding up any digit equal or greater than 5. For example, 5.5 rounds off to 6, 4.5 rounds off to 5.

round up. To round, adjusting the part of the numeral that is retained by adding one to the least-significant of its digits, and executing any necessary carries if and only if one or more non-zero digits have been deleted; for example, the numbers 36.5667 and 105.401, when rounded up to 2 decimal places, become 36.57 and 105.41, respectively.

row. (1) *See*: **tuple**.
(2) A horizontally corresponding set of entries in a table. *See also*: **tuple**. *Contrast with*: **column**.

row vector. A matrix with only one row. That is, a matrix of size 1-by-*n*. *Contrast with*: **column vector**.

row-major order. A method for storing the elements of a matrix in computer memory, in which the elements are ordered in a row-by-row manner—that is, all elements of row 1, followed by all elements of row 2, etc. *Contrast with*: **column-major order**.

rub-out character. *See*: **delete character**.

run. In sorting, two or more successive items in a set that are in the proper order according to the specified sorting criteria.

SAM. Acronym for **sequential access method**.

scalar. A data item used to represent a single number or entity. *Contrast with*: **vector.**

scale. (1) To adjust the representation of a quantity so that its value is brought within a specified range.
(2) The difference between the original and resulting adjustment as in (1).
(3) A system of mathematical notation such as fixed-point or floating point.

scan. To examine a set of items sequentially.

scatter storage. *See*: **hashing.**

schema. A description of the logical structure of a database. *See also*: **data model; physical schema.**

schema definition language. *See*: **data definition language.**

schema language. *See*: **data definition language.**

scratch. (1) To physically erase data from its medium.
(2) To logically delete the identification of data from its medium.

scratch file. A file used as a work area to hold data temporarily.

scratchpad area (SPA). A portion of computer memory shared by a set of computer programs or processes for some special purpose. For example, memory used by two programs for interprocess communication.

SDS. Acronym for **sequential data set.**

search. (1) The examination of a set of items to find all those having a desired property or properties. For example, to find all items in a file that meet some search criterion.
(2) To examine a set of items as in (1).
(3) To retrieve the results of an examination as in (1).
(4) To retrieve the first item within a set of items as in (1).

search argument. In a search, the value compared with the search key of each item in the set being searched. *See also*: **condition.**

search criterion. In a search, the relationship that a search key must have to the search argument in order for the search to be successful. For example, "NAME equals 'SMITH;'" "SALARY greater than 10000."

search cycle. That portion of a search that is repeated for each item in the set being searched.

search key. In a search, the key within each item in the set being searched that is compared to the search argument. *Syn*: **seek key.**

search language. * *See*: **query language.**
* Deprecated.

search length. (1) For a node in a search tree, the number of nodes that must be examined in order to find that node.
(2) For a search tree, the average search length as in (1) for all nodes in the tree.

search tree. (1) A tree into which items in a set are placed in order for the set to be searched. The tree is traversed according to some searching algorithm, making key comparisons until the search argument is found or the algorithm is halted. For example, a B-tree.
(2) A multiways tree of order m in which each nonterminal node may contain $(m - 1)$ key values and each terminal node, called a leaf, contains associated data for one of the key values contained in its parent node. Each subtree is used to contain all the items with key values falling in the intervals formed by the key values contained in its root node. *See also*: B-tree; binary search tree; digital search tree.

second normal form (2NF). One of the forms used to characterize relations; a relation is said to be in second normal form if it is in first normal form and if every nonprime attribute is fully functionally

dependent on each candidate key of the relation.

FIRST NORMAL FORM

ORDER1 = {ORDER-NO} + DATE + CUSTOMER-NO
+ CUSTOMER-NAME + CUSTOMER-ADDRESS
+ TOTAL-ORDER-AMOUNT

ITEM1 = {ORDER-NO + SEQUENCE-NO} + ITEM-NO
+ ITEM-DESCRIPTION + QUANTITY-ORDERED
+ UNIT-PRICE + EXTENDED-PRICE

SECOND NORMAL FORM

ORDER2 = {ORDER-NO} + DATE + CUSTOMER-NO
+ CUSTOMER-NAME + CUSTOMER-ADDRESS
+ TOTAL-ORDER-AMOUNT

ORDER-ITEM2 = {ORDER-NO + ITEM-NO}
+ QUANTITY-ORDERED
+ EXTENDED-PRICE

ITEM2 = {ITEM-NO} + ITEM-DESCRIPTION
+ UNIT-PRICE

Note: In first normal form, nonprime attributes ITEM-DESCRIPTION and UNIT-PRICE are not functionally dependent on candidate key SEQUENCE-NO. Keys shown in brackets.

Fig 26
Second Normal Form

secondary access method. A collection of techniques designed to allow efficient access to all the target data or data records associated with a set of stated secondary key values in a query.

secondary index. (1) A list associated with an inverted file in which entries in the list point to records in the file that contain identical values for the key field on which the file is inverted.
(2) In a hierarchical database, an index used to establish access to a physical or logical segment by a path different from the one provided by the primary key within the root segment. *Note*: A secondary index allows access on the basis of any field within the segment or any of its dependent segments with secondary indices. *See also*: **secondary processing sequence; source segment.**

secondary key. (1) In sorting and searching, a key that is given lower priority than the primary key within a group of related keys. That is, after sorting, all items having the same primary key will be in order by the secondary key or keys. *Syn*: **minor key.** *Contrast with*: **primary key.**
(2) Within a record, a key that is used to index that record but which does not necessarily uniquely identify that record.

secondary processing sequence. In a hierarchical database, the hierarchical order of segment types in a physical or logical database resulting from a secondary index.

secondary space allocation. The amount of space that is reserved for a particular file after the primary space allocation has been exhausted. *Note*: Some systems allow multiple secondary space allocation operations. When a secondary space allocation is granted to a particular file, that file is said to "increase its extents." *Contrast with*: **primary space allocation.**

seek. * (1) *See*: **search.**
(2) * *See*: **search cycle.**
* Deprecated.

seek key. *See*: **search key.**

segment. (1) A collection of data that is stored or transferred as a unit. [P610.12]
(2) A fixed-length unit of data that contains one or more data items.
(3) In some databases, the smallest unit of data that can be retrieved or stored. *Syn*: **database segment.** *See also*: **child segment; dependent segment; logical segment; parent segment; physical segment; root segment; twin segment.**

select. (1) To identify, within a set of items, all items that meet a particular criterion. *See also*: **extract.**
(2) *See*: **selection** (2).

selection. (1) The process of identifying, within a set of items, all items that meet a particular criterion.
(2) A relational operator that extracts specified tuples from a relation and results in a relation containing only those tuples. Also

called **select**. *See also*: **difference; intersection; join; product; projection; union.**

Student No.	Name	Grade	Homeroom
15	Mary	4	26A
21	Harry	4	27

Fig 27
Selection of Relation *Students* in Fig 11 where GRADE is ≤ 5

selection sort. A sort in which the items in a set are examined to find an item that fits a specified criterion; for example, the smallest item; this item is appended to the sorted set and removed from further consideration; and the process is repeated until all items are in the sorted set. *Syn*: **straight selection sort.** *See also*: **heapsort; quadratic selection sort; repeated selection sort; tree selection sort.**

self-contained. Pertaining to a database management system having a programming language that contains all of the necessary facilities for the control and processing of a database.

separate chaining. Hashing in which collision resolution is handled by building a linked list, called a collision chain, for each position in the hash table to hold the items whose hash values correspond to that position in the hash table. *Syn*: **direct chaining; external chaining.** *Contrast with*: **open-address hashing.**

separating character. *See*: **information separator.**

separation sort. *See*: **distribution sort.**

separator. *See*: **delimiter.**

septet. A group of seven adjacent digits operated upon as a unit. *Syn*: **seven-bit byte.** [1084]

sequence. (1) To place items in a linear arrangement in accordance with the order of the natural numbers. *Note*: Methods or procedures may be specified for other natural linear orders by mapping onto the natural numbers. For example, the sequence may be alphabetic or chronological. *See also*: **collating sequence (2); sort (1).**
(2) The order (2) in which items are arranged. *See also*: collating sequence (1); random number sequence; recursively defined sequence.
(3) A set of items that have been sequenced.
(4) * *See*: **order (1).**
(5) *See*: collating sequence (2).
* Deprecated.

sequence by merging. *See*: **sort by merging.**

sequence check. A check that verifies that a set of items are in a certain sequence.

sequence field. *See*: **key.**

sequencer. A mechanical device or computer program that sequences the items in a set. *See also*: **sorter.**

sequencing key. *See*: **sort key.**

sequential access. Pertaining to the process of storing and retrieving data using the sequential access mode. *Syn*: **physical sequential access; serial access.** *Contrast with*: **direct access; random access.** *See also*: **indexed access; indexed sequential access.**

sequential access method (SAM). A technique for accessing data using sequential access mode. That is, to process a given data record, all data records previous to it must be accessed. *See also*: **basic sequential access method; queued sequential access method.**

sequential access mode. An access mode in which data records are stored and retrieved in such a way that each successive access defines the next record to be retrieved. *Contrast with*: **direct access mode; indexed sequential access mode.**

sequential data set (SDS). *See*: **sequential file.**

sequential file. A file that must be accessed using sequential access; for example, a data file on a magnetic tape. *Syn*: **serial file; sequential data set.** *Contrast with*: **direct data set; indexed file; partitioned data set.**

sequential precedential database. *See*: **hierarchical database.**

sequential search. A search in which the items in a set are examined in order, starting from the first item in the set, until the search is successful or the end of the set is encountered. *Syn*: **linear search.**

serial access. *See*: **sequential access.**

serial file. *See*: **sequential file.**

set. (1) In a CODASYL model or network model, a named collection of records. *Syn*: **CODASYL set.**
(2) In database design, a finite or infinite number of objects of any kind, of entities, or of concepts, that have a given property or properties in common.

set difference. *See*: **difference.**

seven-bit byte. *See*: **septet.**

sextet. A group of six adjacent digits operated upon as a unit. *Syn*: **six-bit byte.** [1084]

shared lock. A lock that allows several processes concurrent access to data. *Note*: at most, only one of the processes is allowed to modify the data and the other processes may only read the data. *Contrast with*: **exclusive lock.**

Shell sort. *See*: **diminishing increment sort.**

Shell's method. *See*: **diminishing increment sort.**

shift character. A control character that determines the alphabetic or numeric shift of character codes in a message.

shift-in character (SI). A code extension character, used to terminate a sequence that has been introduced by the shift-out character, that makes effective the graphic characters of the original character set. *Contrast with*: **shift-out character.**

shift-out character (SO). A code extension character that substitutes, for the graphic characters of the original character set, an alternative set of graphic characters upon which agreement has been reached or that has been designated using code extension procedures. *Contrast with*: **shift-in character.**

SI. Acronym for the **shift-in character.**

sibling node. Relative to a node in a tree, a second node that has the same immediate predecessor or parent node. *Syn*: **brother; sister.**

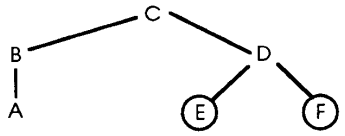

Fig 28
Nodes E and F are Sibling Nodes

sifting sort. *See*: **bubble sort.**

sign character. A character within a picture specification that represents the sign of a data item. *Note*: S, +, and - are commonly used as sign characters.

signed. Pertaining to a representation of a number with which an algebraic sign is associated.

significant code. A code that identifies a particular item and also yields further information about the properties or classification of the item. *Contrast with*: **non-significant code.**

significant digit. A digit that contributes to the accuracy or precision of a numeral. *See also*: **least significant digit; most significant digit.** [1084]

significant figure. * *See*: **significant digit.**
* Deprecated.

simple path. A path in which all vertices except the first and last in the sequence are distinct.

simultaneous access. *See*: **immediate access.**

single precision. Pertaining to the use of a single computer word to represent a number. *Contrast with*: **double precision; multiple precision; triple precision.** [1084]

singly linked list. *See*: **linked list.**

sister. *See*: **sibling node.**

six-bit byte. *See*: **sextet.**

snapshot. A copy of all or portions of the data contained in storage or in a database at a particular point in time. *Note*: Considered a "picture" of the data.

SO. Acronym for the **shift-out character.**

son. *See*: **child node.**

son file. A file that contains data that have been updated from those in another file, called the father file. *See also*: **grandfather file.**

sort. (1) To arrange items according to a specified order of their sort keys. For example, to arrange the records of a personnel file into alphabetical sequence using the sort key "Employee-name." *See also*: **distribution sort; exchange sort; external sort; insertion sort; internal sort; merge sort; radix sort; selection sort.**
(2) To segregate items into subsets according to specified criteria.
(3) A process that achieves the arrangement or segregation described in (1) or (2).

sort by merging. To sort the items of a set by splitting the set into subsets, sorting the subsets, and merging the subsets. *Syn*: **sequence by merging.** *See also*: **order by merging.**

sort key. A key field whose value is used to determine the position of items within a sorted set. *See also*: **sort (2); sorting string.** *Syn*: **sequencing key; sorting-sequencing key.**

sort order. * *See*: **order (2).**
* Deprecated.

sort pass. (1) In a sorting algorithm, a single processing of all the items of a set.
(2) A phase of a merge sort that reads a subset of unsorted data items, orders them, and places the ordered subset on a data medium. This process is repeated until all input data is placed in some subset. The merge phase is then begun to merge the subsets into one ordered set.

sort selection. (1) The choice of a particular sorting algorithm.
(2) The process of choosing an item to be exchanged with another item as part of a selection sorting process. *See*: **sorting item.**

sorter. A mechanical device that deposits punched cards in pockets based on the hole patterns in the cards.

sorting item. (1) That item of a set that is actively being exchanged or manipulated with other elements during the sorting process. *See also*: **sort selection.**
(2) Any element of a set that has a probability of being selected by a sort selection.

sorting rewind time. In a tape merge sort, the length of time needed to rewind a tape to its original position.

sorting string. A string of characters used as a sort key.

sorting-sequencing key. *See*: **sort key.**

source segment. In a hierarchical database, a segment that contains the data used to construct a secondary index.

SP. Abbreviation for the **space character.**

SPA. Acronym for **scratchpad area.**

space. (1) A site intended for the storage of data such as a location in a storage medium.
(2) A basic unit of area such as the size of a single character.
(3) One or more space characters.

space character (SP). A graphic character that is usually represented by a blank site in a series of graphics. The space character, though not a control character, has the function equivalent to that of a format effector

that causes the print or display position to move one position forward without producing the printing or display of any graphic. Similarly, the space character may have a function equivalent to that of an information separator. *See also*: **null character**; **space**.

spanned record. A record that is partially contained in more than one block; that is, it spans a block boundary. *See also*: **blocked record; unblocked record**.

special character. (1) A character that is not in the alphabet, but that is used for punctuation or another special purpose. For example, blank, comma, period, or asterisk.
(2) A graphic character in a character set that is not a letter, not a digit, and not a space character. [ANDIPS/ISO]
(3) In COBOL, a character that is neither numeric nor alphabetic.

stack. (1) A list in which items are appended to and retrieved from the same end of the list, known as the top. That is, the next item to be retrieved is the item that has been in the list for the shortest time. *Syn*: **push-down list**; **push-down stack**; **push-down storage**; **storage stack**. *Contrast with*: **queue**.
(2) A line formed by items waiting for service in a system in which the next item to exit the line is the item that has been in the line for the shortest time.
(3) To arrange in, or to form a stack as in (1).

stack indicator. *See*: **stack pointer**.

stack pointer. A data item that specifies the address of the data item most recently stored in a stack. *Syn*: **stack indicator**.

stand-alone data dictionary. *See*: **passive data dictionary**.

standard form. *See*: **normalized form**.

standardize. *See*: **normalize**.

start signal. A signal at the beginning of a start-stop character that prepares the receiving device for the reception of the code elements. *Note*: A start signal is limited to one signal element generally having the duration of unit interval.

start-stop character. A character including one start signal at the beginning and one or two stop signals at the end. [ANDIPS/ISO]

stop signal. A signal at the end of a start-stop character that prepares the receiving device for the reception of a subsequent character. *Note*: A stop signal is usually limited to one signal element having any duration equal to or greater than a specified minimum value.

storage. In a computer, one or more bytes that are used to store data.

storage access. *See*: **access**.

storage location. An area in a storage device that can be explicitly and uniquely specified by means of an address.

storage schema. In a CODASYL database, statements expressed in data storage definition language that describe storage areas, stored records, and any associated indices and access paths supporting the records and sets defined by a given schema. *See also*: **CODASYL database**.

storage stack. *See*: **stack**.

storage structure. (1) The manner in which data structures are represented in storage.
(2) The configuration of a database resident on computer storage devices after mapping the data elements of the logical structure of the database onto their respective physical counterparts. *Note*: The relationships and associations that provide the physical means for accessing the information stored in the database are preserved.

store. (1) To retain data in a storage device.
(2) To place data into a storage device. *Contrast with*: **retrieve**.

stored record. *See*: **internal record**.

straight insertion sort. *See*: **insertion sort**.

straight line sort. *See*: **linear sort**.

straight radix sort. A radix sort in which items are sorted repeatedly on successive digits within the numeric representation of the sort key, starting with the least significant digit.

straight selection sort. *See*: **selection sort.**

straight two-way merge sort. A variation of the natural two-way merge sort in which the set to be sorted is repeatedly divided into two ordered subsets of length 2 to the power of k, where k is the number of passes made so far. *Contrast with*: **natural two-way merge sort.**

string. (1) A sequence of bits, characters, or other entities; for example, the bit string 0101010 or the character string XYZ. *See also*: **bit string; character string.**
(2) Pertaining to data that contains a sequence as in (1). *Contrast with*: **arithmetic.**

SUB. Abbreviation for the **substitute character.**

subdatabase. A subset of the data contained in a database as used for a specific type of application or system.

subgraph. A graph consisting of a subset of nodes from a larger graph.

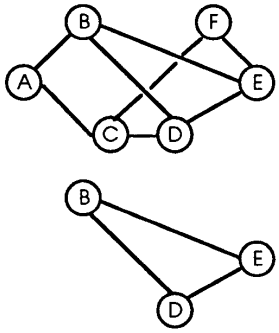

Fig 29
Graph and Subgraph

submodel. *See*: **subschema.**

subschema. (1) A subset of a schema that defines a view of the database that is needed by one or more application programs. *Syn*: **submodel.** *See also*: **external model.**
(2) A description of the logical structure of a record in a database.

subscript. A symbol that is associated with the name of a set to identify a particular subset or element of the set.

substitute character (SUB). A control character used in the place of a character that is recognized to be invalid or in error, or that cannot be represented on a given device. [ANDIPS/ISO]

subtree. A tree whose root node is part of a larger tree. *Note*: A subtree is made up of a node and all of its hierarchical descendants. *Syn*: **branch.**

symbol. *See*: **code.**

symmetric traversal. *See*: **inorder traversal.**

synonym. In hashing, an item whose hash value is identical to that of another item. *See also*: **collision resolution.**

system. A collection of components organized to accomplish a specific function or set of functions. [P610.12]

table. A two-dimensional array. *See also*: **code-decode table.** (See Fig 27 for an example.)

State	Abbreviation	Zone
Alabama	AL	2
Alaska	AK	9
...		
West Virginia	WV	3
Wisconsin	WI	4
Wyoming	WY	3

Fig 30
Table

table lookup (TLU). The process of obtaining the value y corresponding to an argument x from a two-dimensional table of (x,y) pairs. *See also*: **associative lookup; direct lookup.**

tabulation character. A format effector character that causes the print or display position to move to the next corresponding horizontal or vertical position in a series of predetermined positions. *See also*: **horizontal tabulation character; vertical tabulation character.**

tag. One or more characters associated with a set of data, containing information about the set.

tag sort. A sort that uses the address table sorting technique.

tape merge sort. An external merge sort in which the auxiliary storage used is a magnetic tape. *See also*: **direct-access merge sort.**

terminal node. In a tree, a node that has no subtrees. *Syn*: **external node; end point.** *Contrast with*: **nonterminal node.** *See also*: **leaf; root node.**

ternary relation. A relation with three attributes.

third normal form (3NF). One of the forms used to characterize relations; a relation is said to be in third normal form if it is in second normal form and if no nonprime attribute is transitively dependent on the primary key. *See also*: **Boyce/Codd normal form.** (See Fig 31.)

thread. In a tree, a set of link fields, one in each node, each of which points to the successor or predecessor of that node with respect to a particular traversal order.

threaded tree. A tree whose nodes contain link fields for one or more threads, allowing nonrecursive traversal of the tree. *See also*: **doubly-threaded tree; left-threaded three; right-threaded tree; triply-threaded tree.**

three-bit byte. *See*: **triplet.**

TLU. Acronym for **table lookup.**

top. In a queue or a stack, the position of the next item to be retrieved. *Contrast with*: **bottom.**

SECOND NORMAL FORM

ORDER2 = {ORDER-NO} + DATE + CUSTOMER-NO
+ CUSTOMER-NAME
+ CUSTOMER-ADDRESS
+ TOTAL-ORDER-AMOUNT

ORDER-ITEM2 = {ORDER-NO + ITEM-NO}
+ QUANTITY-ORDERED
+ EXTENDED-PRICE

ITEM2 = {ITEM-NO} + ITEM-DESCRIPTION
+ UNIT-PRICE

THIRD NORMAL FORM

ORDER3 = {ORDER-NO} + DATE + CUSTOMER-NO
+ TOTAL-ORDER-AMOUNT

CUSTOMER3 = {CUSTOMER-NO}
+ CUSTOMER-NAME
+ CUSTOMER-ADDRESS

ORDER-ITEM3 = {ORDER-NO + ITEM-NO}
+ QUANTITY-ORDERED + EXTENDED-PRICE

ITEM3 = {ITEM-NO} + ITEM-DESCRIPTION
+ UNIT-PRICE

Note: In second normal form, nonprime attributes CUSTOMER-NAME and CUSTOMER-ADDRESS are transitively dependent on CUSTOMER-NO. Keys shown in brackets.

Fig 31
Third Normal Form

tournament sort. A repeated selection sort in which each of the subsets that make up the set to be sorted consists of no more than two items.

trailing zero. A zero that comes after the last digit in a numeric representation that is non-zero, and that is to the right of the decimal point; for example, the two zeros in "324.600." *Contrast with*: **leading zero.**

transfer. To send data from one place to another place. *See also*: **transmit.** [P610.12]

transient read. *See*: **dirty read.**

transitive dependency. A type of dependency among attributes in a relation, in which a nonprime attribute A is said to be transitively dependent on another attribute B if

and only if there is another attribute C that is functionally dependent on B and functionally determining A but not B. *Contrast with*: **nontransitive dependency**.

translate. To transform data from one language to another.

transliterate. To convert data character-by-character from one character set to another.

transmission control character. (1) Any control character used to control or facilitate transmission of data.
(2) Any character transmitted that is not part of the message being transferred, but that is used to control or to facilitate the transfer. *Syn*: **communication control character.**

transmit. To send data from one place for reception elsewhere. *See also*: **transfer**.

transparent. (1) In data transmission, pertaining to information that does not contain transmission control characters.
(2) To perform in a manner that is invisible to, and of no concern to a user. For example, a computer program may perform file allocation, database operations, and housekeeping operations **transparent** to its user.

transposed file. A file in which corresponding fields in corresponding records are stored contiguously, in contrast to the usual practice of storing entire records contiguously.

traversal. The process of enumerating or visiting each of the nodes of an ordered tree exactly once. *See also*: **converse inorder traversal; converse preorder traversal; converse postorder traversal; inorder traversal; preorder traversal; postorder traversal; traverse; traversal order.**

traversal order. The order in which the nodes of a tree are visited in a traversal.

traverse. To enumerate or to visit each of the nodes of an ordered tree exactly once. *See also*: **traversal**.

tree. A nonlinear data structure consisting of a finite set of nodes in which one node is called the root node and the remaining nodes are partitioned into disjoint sets, called subtrees, each of which is itself a tree. *Note*: The nodes are connected by pointers. *Syn*: **rooted tree; tree structure.** *See also*: **height-balanced tree; null tree; n-ary tree; *n-m* tree; ordered tree; search tree; subtree; threaded tree; trie; unordered tree.**

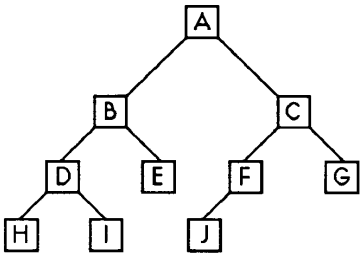

Fig 32
Tree

tree insertion sort. An insertion sort in which the items in the set to be sorted are treated as nodes on a tree. *Contrast with*: **tree selection sort.**

tree selection sort. A selection sort in which the items in the set to be sorted are treated as nodes on a tree. *See also*: **quadratic selection sort.** *Contrast with*: **tree insertion sort.**

tree structure. *See*: **tree.**

trie. An n-ary tree each of whose nonterminal nodes is the parent of a sequence of subtrees, where the k-th subtree represents the k-th digit or character in an n-character alphabet. *Note 1*: A sequence of nodes (length p) from the root of a trie to the root of a subtree represents the first p digits or characters of the keys of the elements represented by that subtree. *Note 2*: The term is pronounced "try" and is derived from the word "re-trie-val." *See also*: **binary radix trie search; multiway radix trie search; radix trie search.**

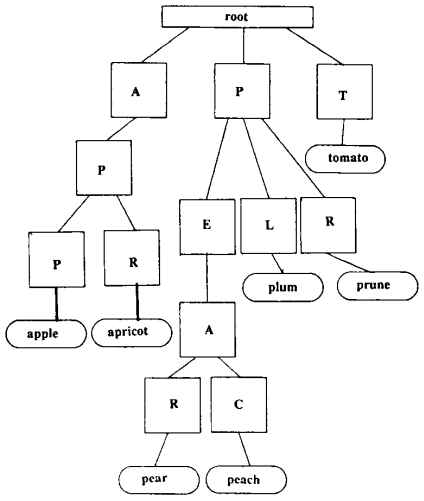

Fig 33
Trie

triple precision. Pertaining to the use of three computer words to represent a number in order to preserve or gain precision. *Contrast with*: **double precision; single precision.** *See also*: **multiple precision.** [1084]

triplet. A group of three adjacent digits operated upon as a unit. *Syn*: **three-bit byte.**

triply-threaded tree. A binary tree in which each node contains three link fields: one for its parent node and one for each of its left child and right child nodes. *Contrast with*: **doubly-threaded tree.**

truncate. (1) To remove the beginning or ending entities in a string; for example, the string 'PINEAPPLE,' when truncated on the right to six characters, is 'PINEAP.'
(2) To delete or omit one or more of the digits in a representation of a number; for example, the numbers 57.5634 and 25.437, when truncated to two decimal digits, become 57.56 and 25.43. *Contrast with*: **round.**

truncation. The process of truncating.

tuple. (1) A suffix meaning "an ordered set of items," as in *n*-tuple.
(2) In a relational data model, a set of values of related attributes. *Note*: Often thought of as a row in a table. *Syn*: **row.** *See also*: **attribute; relation.**

twin segment. In a hierarchical database, a child segment N that shares a common parent segment with another child segment M. Segments N and M are said to be twin segments. *See also*: **logical twin segment; physical twin segment.**

two-way chain. *See*: **doubly linked list.**

two-way insertion sort. An insertion sort in which each item in the set to be sorted is inserted in its proper position in the sorted set such that the first item is placed in the middle of the output set and space is made for subsequent items by moving the previously-inserted items to the right or left. *Contrast with*: **binary insertion sort.**

two-way merge sort. A merge sort in which the set to be sorted is divided into two subsets, the items in each subset are sorted, and the subsets are merged by comparing the smallest items of each subset, outputting the smallest of those, then repeating the process. *See also*: **multiway merge sort; natural two-way merge sort; straight two-way merge sort.**

unary relation. A relation with one attribute.

unbalanced merge. A merge in which the subsets to be merged are unequally distributed among half of the available auxiliary storage devices, then the subsets are merged onto the other half of the auxiliary storage devices. *Contrast with*: **balanced merge.**

unbalanced merge sort. A merge sort in which the sorted subsets created by internal sorts are unequally distributed among some of the available storage, the subsets are merged onto the remaining available storage, and this process is repeated until all the items are in one sorted set. *Contrast with*: **balanced merge sort.** *See also*: **polyphase merge sort.**

unblock. * *See*: **deblock.**
* Deprecated.

unblocked record. A record that is contained in exactly one entire block. *See also*: **blocked record; spanned record.**

undirected graph. A graph in which no direction is implied in the internode connections. *Contrast with*: **directed graph.**

uniform probing. Open-address hashing in which collision resolution is handled by selecting positions at uniform distances from the original position in the hash table until an available position is found. *Contrast with*: **linear probing; quadratic probing; random probing.**

union. A relational operator that combines two relations of the same degree and results in a relation containing all of the tuples that are in either of the original relations. *See also*: **difference; intersection; join; product; projection; selection.**

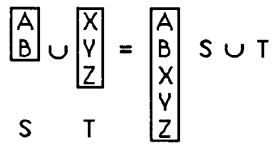

Fig 34
Union

unit string. A string consisting of only one entity.

unnormalized form. The form assumed by data that have not been normalized. *Contrast with*: **normalized form.**

unnormalized relation. A relation that is not in normal form. *Contrast with*: **normalized relation.**

unordered list. A list in which data items are not arranged in any specific order. *Contrast with*: **ordered list.** *Syn*: **random-ordered list.**

unordered tree. A tree in which the left-to-right order of the subtrees of a given node is not significant. *Contrast with*: **ordered tree.**

unpack. To recover the original form of one or more data items from packed form. *Contrast with*: **pack.** [P610.12]

unpacked decimal data. *See*: **zoned decimal data.**

unsigned packed decimal data. Integer data in which each decimal digit is represented in binary, occupying four bits. *Note*: Since no sign is stored, only non-negative integers can be represented. *See also*: **packed decimal data.**

decimal	75_{10}
unsigned packed decimal	$0111\ 0101_2$

update. (1) To change information in accordance with information that is more recent than that which was available previously. For example, a master file containing account balances might be updated nightly to reflect transactions precessed the previous day.
(2) To replace data in a storage device or on a data medium. *See also*: **delete; read; write.**

update access. A type of access to data in which the data can be updated. *See also*: **delete access; read-only access; read/write access; write access.**

upload. (1) To transfer some collection of data from some storage location to a computer memory.
(2) To transfer some collection of data from the memory of a small computer to the memory of a relatively larger computer; for example, to transfer data from a microcomputer to a mainframe computer.

user program. A computer program that is written and used by a specific user of a computer system.

user working area. A work area used by a database management system to load and unload data in response to a call by some application program for data. *Syn*: **workspace.**

user-defined data type. A non-standard data type determined to meet the needs of a

particular user or to solve a particular problem.

V format. *See*: **variable format.**

validity check. A consistency check that is based upon known limits relating to particular data. For example, a month may not be numbered greater than 12, and week cannot have more than 168 hours.

value. *See*: **data value.**

variable format (V format). A file organization in which logical records are of variable length. *Contrast with*: **fixed format.**

variable length. Pertaining to a record or field that does not have a constant length, but whose length depends on the length of the specific data contained in it. *Contrast with*: **fixed-length.** *See also*: **variable format.**

variable length field. A field whose length may vary according to data stored. *Contrast with*: **fixed length field.** *See also*: **variable format.**

variable name data element. A data element whose name can vary depending upon the particular data item represented; for example, a data element named "Population of X in Y," where X takes on the name of a city and Y represents a given year.

variable point. Pertaining to a numeration system in which the position of the radix point is indicated by a special character at that position. *Contrast with*: **fixed point; floating point.** [1084]

vector. A quantity represented by an ordered set of numbers; for example, a one-dimensional array. *Contrast with*: **scalar.** *See also*: **column vector; row vector.**

vertical tabulation character (VT). A format effector character that causes the print or display position to move to the corresponding position on the next of a series of predetermined lines.

view. (1) A subset of a relational database, formed by applying relational operations to the base relations represented. *See also*: **logical database.**
(2) A subset of a data model.
(3) *See*: **external schema.**

view integration. The integration of two or more logical views into a single logical view. *Note*: This is generally done in the normalization stage of database design.

virgin medium. A data medium in or on which data have never been recorded.

virtual attribute. An attribute that is derived from stored data by means of user-defined operations rather than being stored.

virtual field. A field that appears to be but is not physically stored; rather, it is constructed or derived from existing data when its contents are requested by an application program.

virtual point picture character. *See*: **radix point character.**

virtual record. A record that appears to be but is not physically stored; rather, it is constructed or derived from existing data when its contents are requested by an application program.

virtual relation. A relation that is not stored in a database in the form in which the user sees it, but is instead derived from base relations using user-defined operations.

virtual sequential access method (VSAM). An access method for direct or sequential access to data records on storage devices in which auxiliary storage can be addressed as though it were part of main storage. Pages of data are transferred as needed between auxiliary and main storage. *See also*: **basic sequential access method; indexed sequential access method; queued sequential access method.**

visit. To access the node of a tree during a traversal.

volume. (1) A portion of data that, together with it's data carrier, can be handled as a unit. *Syn*: **physical volume.**

(2) A data carrier that is mounted and demounted as a unit; for example a disk pack or a reel of magnetic tape.

volume label. *See*: **end-of-volume label.**

VSAM. Acronym for **virtual sequential access method.**

VT. Acronym for **vertical tabulation character.**

weight. For a given node in a tree, the number of terminal nodes in the subtree for that node.

weight-balanced tree. A binary tree in which the ratio of the weight of the left subtree to the weight of the right subtree is between the square root of two plus and minus one. *Contrast with*: **height-balanced tree.**

word. (1) A sequence of bits or characters that is stored, addressed, transmitted, and operated on as a unit within a given computer. *Syn*: **computer word; machine word; fullword.** *See also*: **byte.** [1084]
(2) An element of computer storage that can hold a sequence of bits or characters as in (1). [P610.12]

work file. (1) A file used to provide storage space for data that is needed only during the duration of a particular event, such as the execution of a computer program.
(2) In sorting, an intermediate file used for temporary storage of data between phases of the sort.

workspace. *See*: **user working area.**

write. To record data in a storage device or on a data medium. *Contrast with*: **read.** *See also*: **delete; store; update.** [P610.12]

write access. A type of access to data in which data may be written. *See also*: **delete access; read-only access; read/write access; update access.** *Syn*: **write-only access.**

write-only access. *See*: **write access.**

zero fill. To fill the digit positions of a storage medium with the representation of the character zero. *Syn*: **zeroize.** [1084]

zero-suppression character. A character within a picture specification that represents a decimal digit in which a blank character is used in place of a zero. *Note*: Z, Y, and * are commonly used.

zeroize. *See*: **zero fill.**

zoned decimal data. Integer data in which each decimal digit occupies one byte, the first four bits of which is called the zone portion and the second four bits, the data portion. The zone portion of the lowest-order byte contains the sign of the integer (hexadecimal A, C, E, or F for positive; B or D for negative); otherwise the zone portion contains the binary value 1111. *Syn*: **unpacked decimal data.**

decimal	75_{10}
zoned decimal	$0000\ 0111\ 1111\ 0101_2$
decimal	-91_{10}
zoned decimal	$0000\ 1001\ 1011\ 0001_2$

THIS PAGE WAS
BLANK IN THE ORIGINAL

THIS PAGE WAS
BLANK IN THE ORIGINAL

ISBN 1-55937-039-4