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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 22*, Programming languages, their environments and system software interfaces*.

This third edition cancels and replaces the second edition (ISO/IEC 1989:2014), which has been technically revised.

The main changes are as follows:

- The following were general enhancements:
  - An asynchronous messaging facility using the SEND statement and RECEIVE statement
  - Boolean exclusive or operators
  - Boolean shifting operators
  - COBOL words may now be 63 characters long
  - The PERFORM statement has been enhanced to specify a time period for pausing the program
  - A DELETE FILE statement
  - A nonfatal EC-I-O-WARNING exception condition to handle warnings for successful input-output statements
  - EXTERNAL attributes checking between programs
  - Infinite loop for the PERFORM statement using the UNTIL EXIT phrase

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- Inline exception handling using the exception-checking format of the PERFORM statement
- An Enhanced INSPECT statement to inspect backwards
- Line Sequential file organization
- The SET statement has been enhanced to allow the setting of the length of a dynamic length elementary item
- Alternate key suppression on indexed files using the SUPPRESS WHEN phrase of the ALTERNATE RECORD KEY clause
- An optional Commit and rollback processing facility using the COMMIT statement and ROLLBACK statement
- Unsigned Packed-Decimal items defined by the NO SIGN phrase of the USAGE clause
- User-defined PICTURE clause editing using the EDITING phrase of the PICTURE clause
- VALUE clause enhancements and changes for numeric-edited items
- Type declarations may now be external items

— The following intrinsic functions were added or enhanced:
  - BASECONVERT function
  - CONCAT function
  - CONVERT function
  - EXCEPTION-FILE function and EXCEPTION-FILE-N function
  - FIND-STRING function
  - MODULE-NAME function
  - SMALLEST-ALGEBRAIC function
  - SUBSTITUTE function
  - TRIM function

— Additional compiler directives were added:
  - COBOL-WORDS directive
  - DISPLAY directive
  - FLAG-14 directive
  - POP directive
  - PUSH directive
  - REF-MOD-ZERO-LENGTH directive

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

COBOL began as a business programming language, but its present use has spread well beyond that to a general purpose programming language.

Any organization interested in reproducing the COBOL standard and specifications in whole or in part, using ideas from this document as the basis for an instruction manual or for any other purpose, is free to do so. However, all such organizations are requested to reproduce the following acknowledgment paragraphs in their entirety as part of the preface to any such publication (any organization using a short passage from this document, such as in a book review, is requested to mention "COBOL" in acknowledgment of the source, but need not quote the acknowledgment):

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For more details and additional changes, see E.2, Substantive changes potentially affecting existing programs and E.3, Substantive changes probably not affecting existing programs.

Further development of the COBOL language is a continuing process to provide facilities to satisfy user demand for the improved usability of the language and the adoption of relevant advances in techniques developed in the computer industry as a whole, including the desirability of interoperability with a wide variety of operating systems and other programming languages to enable developers to take advantage of their facilities, including pre-existing task solutions that then don't need to be repeated.

Annexes A, Language element lists B, Characters permitted in user-defined words, and C, Mapping of uppercase letters to lowercase letters in the COBOL character repertoire form a normative part of this document. Annexes D through G are for information only.

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Annex D, Concepts, includes an explanation of major features as well as the more complicated prior features and is the suggested starting point for the reading of this document.

A complete list of technical changes is given in Annex E, Substantive changes list.

The previous COBOL standard was published in 2014. Implementors have provided language extensions in response to the demands of their users. Several changes and extensions have, therefore, been made in this document to prevent further divergence, and to ensure consistency among, and coherence within, various implementations.

Development of the COBOL language began before the invention of formal techniques for specification of programming languages. Hence, the COBOL standard uses its own description techniques, which are described in Clause 5, Description techniques. These techniques involve general formats, which describe the syntax, and natural language.

During the development of this document, great care was taken to minimize changes that would affect existing programs. Most substantive changes that potentially affect existing programs were introduced to resolve ambiguities in the previous COBOL standard. Details of the substantive changes are given in Annex E, Substantive changes list.

In this document, the following verbal forms are used:

— ‘shall’ indicates a requirement;
— ‘should’ indicates a recommendation;
— ‘can’ indicates a possibility or a capability;
— ‘may’ indicates a permission.

Information marked as ‘NOTE’ is intended to assist the understanding or use of the document. ‘Notes to entry’ used in Clause 3 provide additional information that supplements the terminological data and can contain requirements relating to the use of a term.

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Information technology — Programming languages, their environments and system software interfaces — Programming language COBOL

1 Scope

This document specifies the syntax and semantics of COBOL. Its purpose is to promote a high degree of machine independence to permit the use of COBOL on a variety of data processing systems.

This document specifies:

— The form of a compilation group written in COBOL.

— The effect of compiling a compilation group.

— The effect of executing run units.

— The elements of the language for which a conforming implementation is required to supply a definition.

— The elements of the language for which meaning is explicitly undefined.

— The elements of the language that are dependent on the capabilities of the processor.

This document does not specify:

— The means whereby a compilation group written in COBOL is compiled into code executable by a processor.

— The time at which method, function, or program runtime modules are linked or bound to an activating statement, except that runtime binding occurs of necessity when the identification of the appropriate program or method is not known at compile time.

— The time at which parameterized classes and interfaces are expanded.

— The mechanism by which locales are defined and made available on a processor.

— The form or content of error, flagging, or warning messages.

— The form and content of listings produced during compilation, if any.

— The form of documentation produced by an implementor of products conforming to this document.

— The sharing of objects and resources other than files among run units.

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 60559:2020, *Information technology — Microprocessor systems — Floating-Point Arithmetic*

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

ISO/IEC 1001:2012, *Information technology — File structure and labelling of magnetic tapes for information interchange*

ISO 8601-1:2019, *Date and time — Representations for information interchange — Part 1: Basic rules*

ISO/IEC/IEEE 9945:2009, *Information technology — Portable Operating System Interface (POSIX®) Base Specifications, Issue 7*

ISO/IEC 10646, *Information technology — Universal Coded Character Set (UCS)*

ISO/IEC 14651:2020, *Information technology — International string ordering and comparison — Method for comparing character strings and description of the common template tailorable ordering*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp
— IEC Electropedia: available at https://www.electropedia.org/

3.1
absolute item
item in a report that has a fixed position on a page

3.2
activated runtime element
function, method, or program placed into the active state

3.3
activating statement
statement that causes the execution of a function, method, or program

3.4
activating runtime element
function, method, or program that executed a given activating statement

3.5
active state
state of a function, method, or program that has been activated but has not yet returned control to the activating runtime element

3.6
alphabetic character
basic letter or a space character in the COBOL character repertoire

3.7
alphanumeric character
coded character in an alphanumeric coded character set, whether or not there is an assigned graphic symbol for that coded character

3.8
alphanumeric character position
<storage required> amount of physical storage required to store, or presentation space required to print or display, a single character of an alphanumeric character set

3.9
alphanumeric character position
<location within an item> location within an alphanumeric data item of an alphanumeric character

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3.10
alphanumeric character set
alphanumeric coded character set
coded character set that the implementor has designated for representation of data items of usage display and alphanumeric literals

3.11
alphanumeric group item
group item except for a bit group item, a national group item, a strongly-typed group item, or a variable-length group item

3.12
argument
operand specified in an activating statement that specifies the data to be passed

3.13
assumed decimal point
decimal point position that does not involve the existence of an actual character in a data item and has logical meaning with no physical representation

3.14
based data item
data item established by association of a based entry with an actual data item or allocated storage

3.15
based entry
data description entry that serves as a template that is dynamically associated with data items or allocated storage

3.16
basic letter
uppercase letter 'A' through 'Z' or lowercase letter 'a' through 'z' in the COBOL character repertoire

3.17
big-endian
characterized by the arrangement of data within a data item such that its most significant component occupies the lowest (leftmost) component memory address within the item

3.18
bit
smallest unit in a computer's storage structure capable of representing two distinct alternatives

3.19
bit data item
elementary data item of category boolean and usage bit or a bit group item

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3.20
block
physical record
physical unit of data that is normally composed of one or more logical records

3.21
boolean character
unit of information that consists of the value zero or one

3.22
boolean data item
data item capable of containing a boolean value

3.23
boolean expression
expression consisting of one or more boolean operands separated by boolean operator

3.24
boolean position
<storage required> amount of physical storage required to store, or presentation space required to print or display, a single boolean character

3.25
boolean position
<location within an item> the location within a boolean data item of a boolean character

3.26
boolean value
value consisting of a sequence of one or more boolean characters

3.27
byte
sequence of bits representing the smallest addressable character unit in the memory of a given computer

3.28
character boundary
leftmost bit of an addressing boundary in the storage of the computer

3.29
character position
<storage required> amount of physical storage required to store, or presentation space required to print or display, a single character – either an alphanumeric character or a national character

Note 1 to entry: As an example, each element of a combining sequence in the UCS occupies one character position. A UTF-16 surrogate pair occupies two character positions.

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3.30
character position
<location within an item> location within an alphanumeric or national data item of a corresponding alphanumeric or national character

3.31
character-string
sequence of contiguous characters that form a COBOL word, a literal, or a picture character-string

3.32
class
<in object orientation> entity that defines common behavior and implementation for zero, one, or more objects

3.33
class
<of a data item> set of data items having common attributes or a common range of values, defined by the specific clauses in a data description entry; by the definition of a predefined identifier; or by the definition of an intrinsic function

Note 1 to entry: These common attributes or a common range of values are defined by the PICTURE clause (see 13.18.40, PICTURE clause), the USAGE clause, (see 13.18.60, USAGE clause) or the PICTURE and USAGE clauses.

3.34
class
<of data values> set of data values that are permissible in the content of a data item

3.35
class definition
compilation unit that defines a class of objects

3.36
clause
ordered set of consecutive COBOL character-strings whose purpose is to specify an attribute of an entry

3.37
COBOL character repertoire
repertoire of characters used in writing the syntax of a COBOL compilation group, except for comments and the content of non-hexadecimal alphanumeric and national literals

3.38
combining character
member of the Universal Coded Character Set that is intended for combination with the preceding non-combining graphic character or with a sequence of combining characters preceded by a non-combining character

[SOURCE: ISO/IEC 10646:2020, 3.44, modified — wording changes to COBOL usage]

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3.39
common program
program that, despite being directly contained within another program, can be called from any program directly or indirectly contained in that other program

3.40
compilation group
sequence of one or more compilation units submitted together for compilation

3.41
compilation unit
source unit that is not nested within another source unit

3.42
composite sequence
sequence of graphic characters consisting of a base character followed by one or more combining characters

[SOURCE: ISO/IEC 10646:2020, 3.16, modified — wording changes to COBOL usage]

3.43
conditional statement
statement for which the truth value of a specified condition is evaluated and used to determine subsequent flow of control

3.44
conformance
<for object orientation> unidirectional relation that allows an object to be used according to an interface other than the interface of its own class

3.45
conformance
<for parameters> requirements for the relationship between arguments and formal parameters and between returning items in activating and activated runtime elements

3.46
control function
action that affects the recording, processing, transmission, or interpretation of data, and that has a coded representation consisting of one or more bytes

[SOURCE: ISO/IEC 10646:2020, 3.18, modified — wording changes to COBOL usage]

3.47
cultural element
element of data for computer use that can vary dependent on language, geographical territory, or other cultural circumstances

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3.48
currency sign
COBOL character '$', used as the default currency symbol in a picture character-string and as the default currency string that appears in the edited format of data items

Note 1 to entry: Features exist for selection of other currency strings and currency symbols.

3.49
currency string
set of characters to be placed into numeric-edited data items as a result of editing operations when the item includes a currency symbol in its picture character-string

3.50
currency symbol
character used in a picture character-string to represent the presence of a currency string

3.51
current record
record that is available in the record area associated with a file

3.52
current volume pointer
conceptual entity that points to the current volume of a sequential file

3.53
data item
unit of data defined by a data description entry or resulting from the evaluation of an identifier

3.54
decimal point
decimal separator
character used to represent the radix point

3.55
declarative statement
USE statement that defines the conditions under which the procedures that follow the statement will be executed

3.56
de-editing
logical removal of all editing characters from a numeric-edited data item in order to determine that item's numeric value

3.57
delete file statement
FILE format of the DELETE statement

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3.58
delete record statement
RECORD format of the DELETE statement

3.59
delimited scope statement
statement that is terminated by its explicit scope terminator

3.60
digit position
<storage required> amount of physical storage required to store, or presentation space required to print or display, a single digit

3.61
digit position
<location within an item> location within a numeric data item of a digit

3.62
dynamic access
access mode in which specific logical records can be obtained from or placed into a mass storage file in a nonsequential manner and obtained from a file in a sequential manner

3.63
dynamic storage
storage that is allocated and released on request during runtime

3.64
end marker
marker for the end of a source unit

3.65
endianness
ordering of individually addressable components of a given size within a data item of a larger size

3.66
entry
descriptive set of consecutive clauses terminated by a separator period

3.67
entry convention
information required to interact successfully with a function, method, or program

3.68
exception condition
condition detected at runtime that indicates that an error or exception to normal processing has occurred

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3.69
exception object
object that acts as an exception condition

3.70
exception processing procedures
procedures within WHEN phrases within an exception-checking PERFORM statement or within a USE declarative

3.71
exception status indicator
conceptual entity that exists for each exception-name

3.72
EXIT PARAGRAPH statement
EXIT statement with the PARAGRAPH phrase

3.73
EXIT PERFORM statement
EXIT statement with the PERFORM phrase

3.74
EXIT PROGRAM statement
EXIT statement with the PROGRAM phrase

Note 1 to entry: The EXIT PROGRAM statement is an archaic feature. For details see F.1, Archaic language elements.

3.75
EXIT SECTION statement
EXIT statement with the SECTION phrase

3.76
explicit scope terminator
statement-dependent word that, by its presence, terminates the scope of that statement

3.77
extend mode
mode of file processing in which records can be added at the end of a sequential file, but no records can be deleted, read, or updated

3.78
extended letter
letter, other than the basic letters, in the set of characters defined for the COBOL character repertoire

3.79
external data
data that belongs to the run unit and can be accessed by any runtime element in which it is described

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3.80
external media format
form of data suitable for presentation or printing, including any control functions necessary for representation as readable text

3.81
external switch
hardware or software device, defined and named by the implementor, that is used to indicate that one of two alternate states exists

3.82
factory object
single object associated with a class, defined by the factory definition of that class, typically used to create the instance objects of the class

3.83
file
logical entity that represents a collection of logical records

3.84
file connector
storage area that contains information about a file and is used as the linkage between a file-name and a physical file and between a file-name and its associated record area

3.85
file organization
permanent logical file structure established at the time that a file is created

3.86
file position indicator
conceptual entity that either is used to facilitate exact specification of the next record to be accessed, or indicates why such a reference cannot be established

3.87
file sharing
cooperative environment that controls concurrent access to the same physical file

3.88
fixed file attribute
attribute of a physical file that is established when the physical file is created and is never changed during the existence of the physical file

3.89
formal parameter
data-name specified in the USING phrase of the procedure division header that gives the name used in the function, method, or program for a parameter

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3.90
format character
character whose primary function is to affect the layout or processing of characters around it

Note 1 to entry: A format character generally does not have a visible representation of its own.

3.91
function
intrinsic or user-defined procedural entity that returns a value based upon the arguments

3.92
function prototype definition
definition that specifies the rules governing the arguments needed for the evaluation of a particular function, the data item resulting from the evaluation of the function, and all other requirements needed for the evaluation of that function

3.93
graphic character
character, other than a control function or a format character, that has a visual representation normally handwritten, printed, or displayed

[SOURCE: ISO/IEC 10646:2020, 3.28]

3.94
graphic symbol
visual representation of a graphic character or of a composite sequence

[SOURCE: ISO/IEC 10646:2020, 3.29]

3.95
grouping
separation of digits into groups in number and currency formatting

3.96
grouping separator
character used to separate digits in numbers for ease of reading

3.97
high-order end
leftmost position of a string of characters or a string of bits

3.98
hexadecimal digit
character from the set 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F used in the representation of hexadecimal values, where the letters A-F are equivalent to the letters a-f

3.99
i-o mode
mode of file processing in which records can be read, updated, added, and deleted

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3.100
i-o status
conceptual entity that exists for a file, that contains a value indicating the result of the execution of an input-output operation for that file

3.101
imperative statement
statement that specifies an unconditional action or that is a delimited scope statement

3.102
index
conceptual data item, the content of which refers to a particular element in a table

3.103
inheritance
<for classes> mechanism for using the interface and implementation of one or more classes as the basis for another class

3.104
inheritance
<for interfaces> mechanism for using the specification of one or more interfaces as the basis for another interface

3.105
initial state
state of a function, method, or program when it is first activated in a run unit

3.106
inline exception handling
facility to use PERFORM statements with the ability to trap and handle exception conditions within those statements using a WHEN phrase instead of declaratives

3.107
input mode
mode of file processing in which records can only be read

3.108
instance object
single instance of an object defined by a class and created by a factory object

3.109
interface
<of an object> names of all the methods defined for the object, including inherited methods; for each of the methods the ordered list of its formal parameters and the description and passing technique associated with each, any returned value and its description, and exceptions that can be raised

3.110
interface
<the language construct> grouping of method prototypes

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3.111
internal data
all data described in a source unit except external data and external file connectors

3.112
key of reference
key, either prime or alternate, currently being used to access records within an indexed file

3.113
line delimiter
sequence of one or more bytes which terminates a record in a line sequential file

Note 1 to entry: The line delimiter is implementor-defined.

3.114
little-endian
characterized by the arrangement of data within a data item such that its most significant component occupies the highest (rightmost) component memory address within the item

3.115
locale
facility in the user's information technology environment that specifies language and cultural conventions

3.116
lock mode
state of a file for which record locking is in effect that indicates whether record locking is manual or automatic

3.117
low-order end
rightmost position of a string of characters or a string of bits

3.118
message control system
MCS
implementor-defined system that sends and receives messages exchanged between run units

3.119
message-server
run unit that receives a request via a RECEIVE statement from a requestor and returns information to that requestor

3.120
message-tag
implementor-defined unit of data that specifies the requestor or sender of a message and any additional information about the message

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3.121
method invocation
invocation
request to execute a named method on a given object

3.122
method prototype
source element that specifies the information needed for invocation of a method and for conformance checking

3.123
national character position
<storage required> amount of physical storage required to store, or presentation space required to print or display, a single national character

3.124
national character position
<location within an item> location within a national data item of a national character

3.125
national character set
national coded character set
coded character set that the implementor has designated for representation of data items described as usage national and for national literals

3.126
national data item
elementary data item of class national or a national group item

3.127
native arithmetic
mode of arithmetic in which the techniques used in handling arithmetic are specified by the implementor

3.128
native character set
implementor-defined character set, either alphanumeric or national or both, that is used for internal processing of a COBOL runtime module

3.129
native collating sequence
implementor-defined collating sequence, either an alphanumeric collating sequence or a national collating sequence, that is associated with the computer on which a runtime module is executed

3.130
next record
record that logically follows the current record of a file

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3.131
null
<message tag> state of a message-tag that it contains no valid message tag

3.132
null
<object reference> state of an object reference indicating that it contains no valid reference

3.133
null
<address pointer> state of an address pointer that it contains no valid address

3.134
numeric character
<in the rules of COBOL> character that belongs to the following set of digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

3.135
object
unit consisting of data and the methods that act upon that data

3.136
object data
data defined in the factory definition, except for the data defined in its methods, or in the instance definition, except for the data defined in its methods

3.137
object property
property
name that can be used to qualify an object reference to get a value from or pass a value to an object

3.138
open mode
state of a file connector indicating input-output operations that are permitted for the associated file

3.139
optional file
file declared as being not necessarily present each time the runtime module is executed

3.140
outermost program
program, together with its contained programs, that is not contained in any other program

3.141
output file
file that is opened such that it can only be written or extended

3.142
output mode
mode of file processing in which a file is created and records can only be added to the file

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3.143
physical file
physical collection of physical records

3.144
previous record
record that logically precedes the current record of a file

3.145
procedure
paragraph, section, or one or more successive paragraphs or sections that include the executable code

3.146
procedure branching statement
statement that causes the explicit transfer of control to a statement other than the next executable statement in the sequence in which the statements are written

3.147
processor
computing system, both hardware and software, used for compilation of source code or execution of run units, or both

3.148
program prototype definition
definition that specifies the rules governing the class of the parameters expected to be received by a particular called program, and any other requirements needed to transfer control to and get control and return information from that called program

3.149
random access
access mode in which the value of a key data item identifies the logical record that is obtained from, deleted from, or placed into a relative or indexed file

3.150
record key
data item within a record used to identify that record within an indexed file

3.151
record lock
conceptual entity that is used to control concurrent access to a given record within a shared physical file

3.152
record locking
facility for controlling concurrent access to records in a shared physical file

3.153
relative item
item in a report whose position is specified relative to the previous item

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3.154
relative key
data item that contains a relative record number

3.155
relative record number
ordinal number of a record in a file whose organization is relative

3.156
report writer
comprehensive set of data clauses and statements that enable a print layout to be described according to its general appearance rather than through of a series of procedural steps

3.157
requestor
run unit that makes a request to a message server via a SEND statement to receive information back from that message server

3.158
run unit
runtime entity consisting of one or more runtime modules that interact and that function at execution time as an independent entity

3.159
runtime element
element consisting of code and data produced by the compilation of a source element

3.160
runtime module
runtime element consisting of one or more runtime elements that result from the compilation of a compilation unit

3.161
sequential access
access method in which logical records are either placed into a file in the order of execution of the statements writing the records or obtained from a file in the sequence in which the records were written to the file

3.162
sequential file
file that is opened such that it can only be written or read sequentially

3.163
sequential organization
permanent logical file structure in which a record is identified by a predecessor-successor relationship established when the record is placed into the file

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