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Incorporating corrigendum June 2022

BSI Standards Publication

Information technology — Database languages — SQL

Part 1: Framework (SQL/Framework)

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National foreword

This British Standard is the UK implementation of ISO/IEC 9075-1:2016, incorporating corrigendum June 2022. It supersedes BS ISO/IEC 9075 1-4 and 9-11 and 13-14 which are withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by IEC corrigendum June 2022 is indicated in the text by [AC1⟩ ⟨AC1].

The UK participation in its preparation was entrusted to Technical Committee IST/40, Data management and interchange.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Part 1: Framework (SQL/Framework)

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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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/IEC JTC 1, *Information technology,* SC 32, *Data management and interchange*.

This fifth edition of ISO/IEC 9075-1 cancels and replaces the fourth edition (ISO/IEC 9075-1:2011), which has been technically revised. It also incorporates Technical Corrigendum ISO/IEC 9075-1:2011/Cor.1:2013.

A list of all parts in the ISO/IEC 9075 series, published under the general title *Information technology — Database languages — SQL*, can be found on the ISO website.

NOTE The individual parts of multi-part standards are not necessarily published together. New editions of one or more parts can be published without publication of new editions of other parts.

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Introduction

The organization of this part of ISO/IEC 9075 is as follows:

1) Clause 1, "Scope", specifies the scope of this part of ISO/IEC 9075.

2) Clause 2, "Normative references", identifies additional standards that, through reference in this part of ISO/IEC 9075, constitute provisions of ISO/IEC 9075.

3) Clause 3, "Definitions and use of terms", defines terms used in this and other parts of ISO/IEC 9075.

4) Clause 4, "Concepts", describes the concepts used in ISO/IEC 9075.

5) Clause 5, "The parts of ISO/IEC 9075", summarises the content of each of the parts of ISO/IEC 9075, in terms of the concepts described in Clause 4, "Concepts".

6) Clause 6, "Notation and conventions used in other parts of ISO/IEC 9075", defines notation and conventions used in other parts of ISO/IEC 9075.

7) Clause 7, "Annexes to the parts of ISO/IEC 9075", describes the content of annexes of other parts of ISO/IEC 9075.

8) Clause 8, "Conformance", specifies requirements that apply to claims of conformance to all or some of the parts of ISO/IEC 9075.

9) Annex A, "Maintenance and interpretation of SQL", is an informative Annex. It describes the formal procedures for maintenance and interpretation of ISO/IEC 9075.

10) Annex B, "Implementation-defined elements", is an informative Annex. It lists those features for which the body of this part of ISO/IEC 9075 states that the syntax, the meaning, the returned results, the effect on SQL-data and/or schemas, or any other behavior is partly or wholly implementation-defined.

11) Annex C, "Implementation-dependent elements", is an informative Annex. It lists those features for which the body of this part of ISO/IEC 9075 states that the syntax, the meaning, the returned results, the effect on SQL-data and/or schemas, or any other behavior is partly or wholly implementation-dependent.

12) Annex D, "Deprecated features", is an informative Annex. It lists features that the responsible Technical Committee intend will not appear in a future revised version of this part of ISO/IEC 9075.

13) Annex E, "Incompatibilities with ISO/IEC 9075:2011", is an informative Annex. It lists incompatibilities with the previous version of this part of ISO/IEC 9075.

14) Annex F, "SQL feature taxonomy", is an informative Annex. It identifies features of the SQL language specified in this part of ISO/IEC 9075 by an identifier and a short descriptive name. This taxonomy is used to specify conformance.

15) Annex G, "Defect reports not addressed in this edition of this part of ISO/IEC 9075", is an informative Annex. It describes the Defect Reports that were known at the time of publication of this part of this International Standard. Each of these problems is a problem carried forward from the previous edition of this part of ISO/IEC 9075. No new problems have been created in the drafting of this edition of this International Standard.

In the text of this part of ISO/IEC 9075, Clauses and Annexes begin new odd-numbered pages. Any resulting blank space is not significant.

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Information technology — Database languages — SQL —

Part 1:
Framework (SQL/Framework)

1 Scope

This part of ISO/IEC 9075 describes the conceptual framework used in other parts of ISO/IEC 9075 to specify the grammar of SQL and the result of processing statements in that language by an SQL-implementation.

This part of ISO/IEC 9075 also defines terms and notation used in the other parts of ISO/IEC 9075.

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2 Normative references

The following referenced documents are indispensable for the application 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.

2.1 ISO and IEC standards

[ISO9075-2] ISO/IEC 9075-2:2016, *Information technology — Database languages — SQL — Part 2: Foundation (SQL/Foundation)*

[ISO9075-3] ISO/IEC 9075-3:2016, *Information technology — Database languages — SQL — Part 3: Call-Level Interface (SQL/CLI)*

[ISO9075-4] ISO/IEC 9075-4:2016, *Information technology — Database languages — SQL — Part 4: Persistent Stored Modules (SQL/PSM)*

[ISO9075-9] ISO/IEC 9075-9:2016, *Information technology — Database languages — SQL — Part 9: Management of External Data (SQL/MED)*

[ISO9075-10] ISO/IEC 9075-10:2016, *Information technology — Database languages — SQL — Part 10: Object Language Bindings (SQL/OLB)*

[ISO9075-11] ISO/IEC 9075-11:2016, *Information technology — Database languages — SQL — Part 11: Information and Definition Schemas (SQL/Schemata)*

[ISO9075-13] ISO/IEC 9075-13:2016, *Information technology — Database languages — SQL — Part 13: SQL Routines and Types Using the Java™ Programming Language (SQL/JRT)*

[ISO9075-14] ISO/IEC 9075-14:2016, *Information technology — Database languages — SQL — Part 14: XML-Related Specifications (SQL/XML)*

[ISO10646] ISO/IEC 10646, *Information technology — Universal Multiple-Octet Coded Character Set (UCS).*

[ISO14651] ISO/IEC 14651, *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 Definitions and use of terms

3.1 Definitions

3.1.1 Definitions provided in this standard

In this document, the definition of a verb defines every voice, mood, and tense of that verb.

For the purposes of this document and other parts of ISO/IEC 9075, the following definitions apply:

3.1.1.1 atomic
incapable of being subdivided

3.1.1.2 column
field of the row type of a table

3.1.1.3 compilation unit
segment of executable code, possibly consisting of one or more subprograms

3.1.1.4 data type
set of representable values

3.1.1.5 descriptor
coded description of an SQL object

NOTE 2 — It includes all of the information about the object that a conforming SQL-implementation requires.

3.1.1.6 field
(field name, data type) pair

NOTE 3 — A value of a field is a value of its data type.

3.1.1.7 fully qualified (of a name of some SQL object)
with all optional components specified explicitly

NOTE 4 — A fully qualified name does not necessarily identify an object uniquely. For example, although a fully qualified specific name, consisting of a catalog name, a schema name and a specific name, uniquely identifies a routine, a fully qualified routine name doesn't necessarily do so.

3.1.1.8 identifier
object by which something is identified

3.1.1.9 identify
to reference something without ambiguity

3.1.1.10 implementation-defined
possibly differing between SQL-implementations, but specified by the implementor for each particular SQL-implementation

3.1.1.11 implementation-dependent

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possibly differing between SQL-implementations, but not specified by ISO/IEC 9075, and not required to be specified by the implementor for any particular SQL-implementation

3.1.1.12 instance (of a value)
physical representation of a value

NOTE 5 — Each instance is at exactly one site. An instance has a data type that is the data type of its value.

3.1.1.13 null value
special value that is used to indicate the absence of any data value

3.1.1.14 object (as in 'x object')
thing that is a component of, or is otherwise associated with, some x and cannot exist independently of that x

NOTE 6 — For example, an SQL object is an object that exists only in the context of SQL; an SQL-schema object is an object that exists in some SQL-schema.

3.1.1.15 persistent
continuing to exist indefinitely, until destroyed deliberately

NOTE 7 — Referential and cascaded actions are regarded as deliberate. Actions incidental to the termination of an SQL-transaction or an SQL-session are not regarded as deliberate.

3.1.1.16 property (of an object)
attribute, quality, or characteristic of the object

3.1.1.17 row
value of a row type, *i.e.*, a sequence of field values; for rows in a table, a sequence of column values

3.1.1.18 scope (of a standard)
clause in the standard that defines the subject of the standard and the aspects covered, thereby indicating the limits of applicability of the standard or of particular parts of it

3.1.1.19 scope (of a name or declaration)
one or more BNF non-terminal symbols within which the name or declaration is effective

3.1.1.20 scope (of a reference type)
table that a value of that reference type references

3.1.1.21 sequence
ordered collection of objects that are not necessarily distinct

3.1.1.22 site
place occupied by an instance of a value of some specified data type (or subtype of that data type)

3.1.1.23 SQL-connection
association between an SQL-client and an SQL-server

3.1.1.24 SQL-environment
context in which SQL-data exists and SQL-statements are executed

3.1.1.25 SQL-implementation
processor that processes SQL-statements

NOTE 8 — A *conforming SQL-implementation* is an SQL-implementation that satisfies the requirements for SQL-implementations as defined in Clause 8, "Conformance".

3.1.1.26 SQL-session

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context within which a single user, from a single SQL-agent, executes a sequence of consecutive SQL-statements over a single SQL-connection

3.1.1.27 SQL-statement
string of characters that conforms to the Format and Syntax Rules specified in the parts of ISO/IEC 9075

3.1.1.28 table
collection of zero or more rows

3.2 Use of terms

The concepts on which ISO/IEC 9075 is based are described in terms of objects, in the usual sense of the word.

An object might be considered to be a component of the object on which it depends. If an objects ceases to exist, then every object dependent on that objects also ceases to exist. The representation of an object is known as a descriptor. The descriptor of an object represents everything that needs to be known about the object. See also Subclause 6.3.4, “Descriptors”.

3.3 Informative elements

In several places in the body of ISO/IEC 9075, informative notes appear. For example:

NOTE 9 — This is an example of a note.

Those notes do not belong to the normative part ISO/IEC 9075. A claim of conformance to material in a Note is not meaningful.

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4 Concepts

4.1 Caveat

This Clause describes concepts that are, for the most part, specified precisely in other parts of ISO/IEC 9075. In any case of discrepancy, the specification in the other part is to be presumed correct.

4.2 SQL-environments and their components

4.2.1 SQL-environments

An SQL-environment comprises:

— One SQL-agent.

— One SQL-implementation.

— Zero or more SQL-client modules, containing externally-invoked procedures available to the SQL-agent.

— Zero or more authorization identifiers.

— Zero or more user mappings.

— Zero or more routine mappings.

— Zero or more catalogs, each of which contains one or more SQL-schemas, zero or more foreign server descriptors, and zero or more foreign-data wrapper descriptors.

— The sites, principally base tables, that contain SQL-data, as described by the contents of the schemas. This data may be thought of as “the database”, but the term is not used in ISO/IEC 9075, because it has different meanings in the general context.

4.2.2 SQL-agents

An *SQL-agent* is that which causes the execution of SQL-statements. In the case of the direct invocation of SQL (see Subclause 5.3.3.3, “Direct invocation of SQL”), it is implementation-defined. Alternatively, it may consist of one or more compilation units that, when executed, invoke externally-invoked procedures in an SQL-client module.

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4.2.3 SQL-implementations

An *SQL-implementation* is a processor that executes SQL-statements, as required by the SQL-agent. An SQL-implementation, as perceived by the SQL-agent, includes one SQL-client, to which that SQL-agent is bound, and one or more SQL-servers. An SQL-implementation can conform to ISO/IEC 9075 without allowing more than one SQL-server to exist in an SQL-environment.

Because an SQL-implementation can be specified only in terms of how it executes SQL-statements, the concept denotes an installed instance of some software (database management system). ISO/IEC 9075 does not distinguish between features of the SQL-implementation that are determined by the software vendor and those determined by the installer.

ISO/IEC 9075 recognizes that SQL-client and SQL-server software may have been obtained from different vendors; it does not specify the method of communication between SQL-client and SQL-server.

4.2.3.1 SQL-clients

An *SQL-client* is a processor, perceived by the SQL-agent as part of the SQL-implementation, that establishes SQL-connections between itself and SQL-servers and maintains a diagnostics area and other state data relating to interactions between itself, the SQL-agent, and the SQL-servers.

When one or more SQL-connections have been established for an SQL-client, the diagnostics area maintained by that SQL-client is a copy of the first diagnostics area in the diagnostics area stack (see Subclause 4.8.4, "Diagnostic information") maintained by the SQL-server of the current SQL-connection. When no SQL-connection exists, the diagnostics area is either empty or contains diagnostics information pertaining to some failed SQL-connection.

4.2.3.2 SQL-servers

Each *SQL-server* is a processor, perceived by the SQL-agent as part of the SQL-implementation, that manages SQL-data.

Each SQL-server:

— Manages the SQL-session taking place over the SQL-connection between itself and the SQL-client.

— Executes SQL-statements received from the SQL-client, receiving and sending data as required.

— Maintains the state of the SQL-session, including the authorization identifier and certain session defaults.

4.2.4 SQL-client modules

An *SQL-client module* is a module that is explicitly created and dropped by implementation-defined mechanisms.

An SQL-client module does not necessarily have a name; if it does, the permitted names are implementation-defined.

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An SQL-client module contains zero or more *externally-invoked procedures*. An externally-invoked procedure consists of a single SQL-statement. An externally-invoked procedure is invoked from a compilation unit of a host language.

Exactly one SQL-client module is associated with an SQL-agent at any time. However, in the case of either direct binding style or SQL/CLI, this may be a default SQL-client module whose existence is not apparent to the user.

4.2.5 User identifiers

A *user identifier* represents a user. The means of creating and destroying user identifiers, and their mapping to real users, is not specified by ISO/IEC 9075.

4.2.6 Roles

A *role* is a potential grantee and grantor of privileges and of other roles. A role can also own schemas and other objects.

A *role authorization* permits a grantee (see Subclause 4.6.11, "Privileges") to use every privilege granted to the role. It also indicates whether the role authorization is grantable, in which case the grantee is authorized to grant the role, to revoke a grant of the role, and to destroy the role.

4.2.7 User mapping concepts

A user mapping pairs an authorization identifier with a foreign server descriptor.

4.2.8 Routine mapping concepts

A routine mapping pairs an SQL-invoked routine with a foreign server descriptor.

NOTE 10 — In this revision of ISO/IEC 9075, the SQL-invoked routine that is paired with a foreign server descriptor is restricted to be an SQL-invoked regular function. Possible future revisions may drop this restriction.

4.2.9 Catalogs and schemas

4.2.9.1 Catalogs

A *catalog* is a named collection of SQL-schemas, foreign server descriptors, and foreign data wrapper descriptors in an SQL-environment. The mechanisms for creating and destroying catalogs are implementation-defined.

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The default catalog name for <preparable statement>s that are dynamically prepared in the current SQL-session through the execution of <prepare statement>s and <execute immediate statement>s is initially implementation-defined but may be changed by the use of <set catalog statement>s.

4.2.9.2 SQL-schemas

An *SQL-schema*, often referred to simply as a *schema*, is a persistent, named collection of descriptors. Any object whose descriptor is in some SQL-schema is known as an *SQL-schema object*.

A schema, the schema objects in it, and the SQL-data described by them are said to be owned by the authorization identifier associated with the schema.

SQL-schemas are created and destroyed by execution of SQL-schema statements (or by implementation-defined mechanisms).

4.2.9.3 The Information Schema

Every catalog contains an SQL-schema with the name INFORMATION_SCHEMA that includes the descriptors of a number of schema objects, mostly view definitions, that together allow every descriptor in that catalog to be accessed, but not changed, as though it was SQL-data.

The data available through the views in an Information Schema includes the descriptors of the Information Schema itself. It does not include the schema objects or base tables of the Definition Schema (see Subclause 4.2.9.4, "The Definition Schema").

Each Information Schema view is so specified that a given user can access only those rows of the view that represent descriptors on which that user has privileges.

4.2.9.4 The Definition Schema

The *definition schema* is a fictitious schema with the name DEFINITION_SCHEMA; if it were to exist, the SQL-data in its base tables would describe all the SQL-schemas available in a catalog. ISO/IEC 9075 defines it only in order to use it as the basis for the views of the Information Schema.

The structure of the Definition Schema is a representation of the data model of SQL.

4.2.10 Foreign servers and descriptors

A foreign server is a processor that is not part of the SQL-implementation. A foreign server is described by a foreign server descriptor. A foreign server manages data that is not part of the SQL-environment. An SQL-server and an SQL-client can use a foreign server descriptor, which is a catalog element, to communicate with a foreign server. The data managed by a foreign server can be accessed by an SQL-server or an SQL-client through foreign tables, which are SQL-schema elements.

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4.2.11 Foreign-data wrappers and descriptors

A foreign-data wrapper provides the mechanism by which an SQL-server can access the data that is managed by a foreign server. A foreign-data wrapper is described by a foreign-data wrapper descriptor.

4.2.12 SQL-data

SQL-data is data described by SQL-schemas — data that is under the control of an SQL-implementation in an SQL-environment.

4.3 Tables

A *table* is a collection of zero or more rows where each row is an instance of the row type of the table. In general, rows in a table are unordered; however, rows in a table are ordered if the table is the result of a <query expression> that immediately contains an <order by clause>. The columns of a table are the fields of the row type of the table. Each column has a name and a data type. Each row has exactly one value for each column *C*, and the data type of that value is the data type of *C*.

SQL-data consists entirely of table variables, called *base tables*. An operation that references zero or more base tables and returns a table is called a *query*. The result of a query is called a *derived table*. The rows of a derived table may be ordered.

The rows of a table have a type, called “the row type”; every row of a table has the same row type, which is also the row type of the table. A table that is declared to be based on some structured type is called a “typed table”; its columns correspond in name and declared type to the attributes of the structured type. Typed tables have one additional column, called the “self-referencing column” whose type is a reference type associated with the structured type of the table.

If a typed table *TB1* has an associated structured type *TP1* that is a subtype of some other structured type *TP2*, then *TB1* can be defined to be a “subtable” of a typed table *TB2* whose associated type is *TP2*; *TB2* is, in this case, a “supertable” of *TB1*.

A *view* is a named query, which can be invoked by use of this name. The result of such an invocation is called a *viewed table*.

Some queries, and hence some views, are *updatable*, meaning they can appear as targets of statements that change SQL-data. The results of changes expressed in this way are defined in terms of corresponding changes to base tables.

No two columns of a base table or a viewed table can have the same name. Derived tables, other than viewed tables, may contain more than one column with the same name.

A base table is either a schema object (its descriptor is in a schema; see Subclause 4.6.5, “Base tables and their components”) or a module object (its descriptor is in a module; see Subclause 4.9, “Modules”). A base table whose descriptor is in a schema is called a *created base table*, and may be either persistent or temporary (though its descriptor is persistent in either case). A *persistent base table* contains 0 (zero) or more rows of persistent SQL-data. A persistent base table is either a *regular persistent base table* or a *system-versioned table*. System-versioned tables differ from regular persistent base tables in two major respects:

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— System-versioned tables have two columns of datetime type whose values are generated automatically.

— The update and delete operations on system-versioned tables maintain those columns and have additional side effects.

A base table declared in a module is always a temporary table, and is called a *declared local temporary table*.

A *temporary table* is an SQL-session object that cannot accessed from any other SQL-session. A *global temporary table* can be accessed from any associated SQL-client module. A *local temporary table* can be accessed only from the module to which it is local.

A temporary table is empty when an SQL-session is initiated and it is emptied (that is, all its rows are deleted) either when an SQL-transaction is terminated or when an SQL-session is terminated, depending on its descriptor.

4.4 SQL data types

4.4.1 General data type information

Every data value belongs to some data type.

Every data type is either *predefined*, *constructed*, or *user-defined*. Every data type has a name. The name of a predefined or constructed data type is a reserved word specified by that part of ISO/IEC 9075 that specifies the data type. The name of a user-defined type is provided in its definition. A user-defined data type is a schema object; see Subclause 4.6.4, "User-defined types".

A predefined data type is a data type specified by ISO/IEC 9075, and is therefore provided by the SQL-implementation. A data type is predefined even though the user is required (or allowed) to provide certain parameters when specifying it (for example the precision of a number).

A predefined data type is atomic. An atomic type is a data type whose values are not composed of values of other data types. The existence of an operation (SUBSTRING, EXTRACT) that is capable of selecting part of a string or datetime value does not imply that a string or datetime is not atomic.

A constructed type is either atomic or composite. A composite type is a data type each of whose values is composed of zero or more values, each of a declared data type.

4.4.2 The null value

Every data type includes a special value, called the *null value*, sometimes denoted by the keyword NULL. This value differs from other values in the following respects:

— Since the null value is in every data type, the data type of the null value implied by the keyword NULL cannot be inferred; hence NULL can be used to denote the null value only in certain contexts, rather than everywhere that a literal is permitted.

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— Although the null value is neither equal to any other value nor not equal to any other value — it is *unknown* whether or not it is equal to any given value — in some contexts, multiple null values are treated together; for example, the <group by clause> treats all null values together.

4.4.3 Predefined types

4.4.3.1 Numeric types

There are three classes of numeric type: *exact numeric*, which includes integer types and types with specified precision and scale; *approximate numeric*, which is essentially binary floating point, and for which a precision may optionally be specified; and *decimal floating point*, which is essentially decimal floating point. A precision may optionally be specified for both approximate numeric and decimal floating point types.

Every number has a *precision* (number of digits), and exact numeric types also have a scale (digits after the radix point). Arithmetic operations may be performed on operands of different or the same numeric type, and the result is of a numeric type that depends only on the numeric type of the operands. If the result cannot be represented exactly in the result type, then whether it is rounded or truncated is implementation-defined. An exception condition is raised if the result is outside the range of numeric values of the result type, or if the arithmetic operation is not defined for the operands.

4.4.3.2 Character string types

A value of *character string type* is a string (sequence) of characters drawn from some character repertoire. The characters in a character string *S* are all drawn from the same character set *CS*. If *S* is the value of some expression *E*, then *CS* is the character set specified for the declared type of *E*. A character string type is either of fixed length, or of variable length up to some implementation-defined maximum. A value of *character large object type* is a string of characters from some character repertoire and is always associated with exactly one character set. A *large object character string* is of variable length, up to some implementation-defined maximum that is probably greater than that of other character strings.

A character string may be specified as being based on a specific character set by specifying CHARACTER SET in the data type; a particular character set chosen by the implementation to be the *national character set* may be specified by specifying NATIONAL CHARACTER, NATIONAL CHARACTER VARYING, or NATIONAL CHARACTER LARGE OBJECT (or one of several syntactic equivalents) as the data type.

4.4.3.3 Binary string types

A value of *binary string type* is a string (sequence) of octets. A binary string type is either of fixed length or of variable length, up to an implementation-defined maximum. A value of *binary large object type* is a string of octets. A *binary large object string* is of variable length, up to some implementation-defined maximum that is probably greater than that of other binary strings.

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4.4.3.4 Boolean type

A value of the *Boolean* data type is either *true* or *false*. The truth value of *unknown* is sometimes represented by the null value.

4.4.3.5 Datetime types

There are three *datetime types*, each of which specifies values comprising datetime fields.

A value of data type TIMESTAMP comprises values of the datetime fields YEAR (between 0001 and 9999), MONTH, DAY, HOUR, MINUTE and SECOND.

A value of data type TIME comprises values of the datetime fields HOUR, MINUTE and SECOND.

A value of data type DATE comprises values of the datetime fields YEAR (between 0001 and 9999), MONTH, and DAY.

A value of DATE is a valid Gregorian date. A value of TIME is a valid time of day.

TIMESTAMP and TIME may be specified with a number of (decimal) digits of fractional seconds precision.

TIMESTAMP and TIME may also be specified as being WITH TIME ZONE, in which case every value has associated with it a time zone displacement. In comparing values of a data type WITH TIME ZONE, the value of the time zone displacement is disregarded.

4.4.3.6 Interval types

A value of an *interval type* represents the duration of a period of time. There are two classes of intervals. One class, called *year-month intervals*, has an interval precision that includes a YEAR field or a MONTH field, or both. The other class, called *day-time intervals*, has an express or implied interval precision that can include any set of contiguous fields other than YEAR or MONTH.

4.4.3.7 XML type

Values of the XML type are called XML values.

4.4.4 Constructed atomic types

4.4.4.1 Reference types

A *reference type* is a constructed data type, a value of which references (or points to) some site holding a value of the referenced type. The only sites that may be so referenced are the rows of typed tables. It follows that every referenced type is a structured type.

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