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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 32, *Data management and interchange*.

This fifth edition cancels and replaces the fourth edition (ISO/IEC 9075-10:2016), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC 9075-10:2016/Cor.1:2022.

The main changes are as follows:

— improve the presentation and accuracy of the summaries of implementation-defined and implementation-dependent aspects of this document;

— introduction of several digital artifacts;

— alignment with updated ISO house style and other guidelines for creating standards.

This fifth edition of ISO/IEC 9075-10 is designed to be used in conjunction with the following editions of other parts of the ISO/IEC 9075 series, all published in 2023:

— ISO/IEC 9075-1, sixth edition;

— ISO/IEC 9075-2, sixth edition;

— ISO/IEC 9075-3, sixth edition;

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— ISO/IEC 9075-4, seventh edition;

— ISO/IEC 9075-9, fifth edition;

— ISO/IEC 9075-11, fifth edition;

— ISO/IEC 9075-13, fifth edition;

— ISO/IEC 9075-14, sixth edition;

— ISO/IEC 9075-15, second edition;

— ISO/IEC 9075-16, first edition.

A list of all parts in the ISO/IEC 9075 series can be found on the ISO and IEC websites.

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

The organization of this document is as follows:

1) Clause 1, "Scope", specifies the scope of this document.

2) Clause 2, "Normative references", identifies additional standards and publicly-available specifications that, through reference in this document, constitute provisions of this document.

3) Clause 3, "Terms and definitions", defines the terms and definitions used in this document.

4) Clause 4, "Concepts", presents concepts used in the definition of the Object Language Bindings.

5) Clause 5, "Lexical elements", defines the lexical elements of the language.

6) Clause 6, "Scalar expressions", defines the elements of the language that produce scalar values.

7) Clause 7, "Additional common rules", specifies the rules for assignments that retrieve data from or store data into SQL-data, and formation rules for set operations.

8) Clause 8, "Data manipulation", defines the data manipulation statements.

9) Clause 9, "Control statements", defines the SQL-control statements.

10) Clause 10, "Transaction management", defines the SQL-transaction management statements.

11) Clause 11, "Embedded SQL", defines the host language embeddings.

12) Clause 12, "SQLJ reserved names", defines the reserved names for SQLJ.

13) Clause 13, "Common subelements", defines the commonly used subelements for SQLJ.

14) Clause 14, "<SQLJ specific clause> and contents", defines the syntax and rules for SQLJ constructs.

15) Clause 15, "Package sqlj.runtime", specifies the SQLJ runtime package.

16) Clause 16, "Package sqlj.runtime.profile", specifies the SQLJ runtime profile package.

17) Clause 17, "sqlj.runtime.profile.util.ProfileCustomizer", specifies the SQLJ profile customizer class.

18) Clause 18, "Status codes", defines SQLSTATE values related to Object Language Bindings.

19) Clause 19, "Conformance", defines the criteria for conformance to this document.

20) Annex A, "SQL conformance summary", is an informative Annex. It summarizes the conformance requirements of the SQL language.

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

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

23) Annex D, "SQL optional feature taxonomy", is an informative Annex. It identifies the optional features of the SQL language specified in this document by an identifier and a short descriptive name. This taxonomy is used to specify conformance.

24) Annex E, "Deprecated features", is an informative Annex. It lists features that the responsible Technical Committee intends not to include in a future edition of this document.

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25) Annex F, "Incompatibilities with ISO/IEC 9075:2016", is an informative Annex. It lists incompatibilities with the previous edition of this document.

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

In the text of this document, Clauses and Annexes begin new odd-numbered pages. Any resulting blank space is not significant.

All Clauses of this document are normative.

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Information technology — Database language SQL —

Part 10:
Object Language Bindings (SQL/OLB)

1 Scope

ISO/IEC 9075-2 specifies embedded SQL for the programming languages: Ada, C, COBOL, Fortran, MUMPS, Pascal, and PL/I. This document defines similar features of Database language SQL that support embedding of SQL-statements into programs written in the Java[1] programming language. The embedding of SQL into Java is commonly known as "SQLJ". This document specifies the syntax and semantics of SQLJ, as well as mechanisms to ensure binary portability of resulting SQLJ applications. In addition, it specifies a number of Java packages and their contained classes (including methods).

Throughout this document, the terms "SQLJ" and "SQL/OLB" are used synonymously.

1 Java™ is a registered trademark of Oracle Corporation and/or its affiliates.

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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 9075-1, *Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)*

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

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

The Unicode Consortium. *The Unicode Standard (Information about the latest version of the Unicode standard can be found by using the "Latest Version" link on the "Enumerated Versions of The Unicode Standard" page.)* [online]. Mountain View, California, USA: The Unicode Consortium, Available at `https://www.unicode.org/versions/enumeratedversions.html`

Java Community Process. *The Java™ Language Specification* [online]. Java SE 13 Edition. Redwood Shores, California, USA: Oracle, Available at `https://docs.oracle.com/javase/specs/jls/-se13/jls13.pdf`

Java Community Process. *JDBC™ 4.3 Specification* [online]. Edition 4.3. Redwood Shores, California, USA: Oracle, Available at `https://download.oracle.com/otn-pub/jcp/-jdbc-4_3-mrel3-eval-spec/jdbc4.3-fr-spec.pdf`

Java Community Process. *Java Naming and Directory Interface™* [online]. Redwood Shores, California, USA: Oracle, Available at `https://docs.oracle.com/javase/8/docs/technotes/guides/-jndi/index.html`

Java Community Process. *The JavaBeans™ 3.0 Specification* [online]. Edition 3.0. Redwood Shores, California, USA: Oracle, Available at `https://download.oracle.com/otndocs/jcp/-ejb-3_0-pr-spec-oth-JSpec/`

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