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ISO/IEC 9899

Second edition
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Langages de programmation — C

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Programming languages — C

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Foreword

1 ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are member 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.

2 International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

3 In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

4 International Standard ISO/IEC 9899 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 22, *Programming languages, their environments and system software interfaces*. The Working Group responsible for this standard (WG 14) maintains a site on the World Wide Web at **`http://ww.dkuug.dk/JTC1/SC22/WG14/`** containing additional information relevant to this standard such as a Rationale for many of the decisions made during its preparation and a log of Defect Reports and Responses.

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5 This second edition cancels and replaces the first edition, ISO/IEC 9899:1990, as amended and corrected by ISO/IEC 9899/COR1:1994, ISO/IEC 9899/AMD1:1995, and ISO/IEC 9899/COR2:1996. Major changes from the previous edition include:

— restricted character set support via digraphs and **`<iso646.h>`** (originally specified in AMD1)

— wide character library support in **`<wchar.h>`** and **`<wctype.h>`** (originally specified in AMD1)

— more precise aliasing rules via effective type

— restricted pointers

— variable-length arrays

— flexible array members

— **`static`** and type qualifiers in parameter array declarators

— complex (and imaginary) support in **`<complex.h>`**

— type-generic math macros in **`<tgmath.h>`**

— the **long long int** type and library functions
— increased minimum translation limits
— additional floating-point characteristics in **<float.h>**
— remove implicit **int**
— reliable integer division
— universal character names (**\u** and **\U**)
— extended identifiers
— hexadecimal floating-point constants and **%a** and **%A** **printf**/**scanf** conversion specifiers
— compound literals
— designated initializers
— **//** comments
— extended integer types and library functions in **<inttypes.h>** and **<stdint.h>**
— remove implicit function declaration
— preprocessor arithmetic done in **intmax_t**/**uintmax_t**
— mixed declarations and code
— new block scopes for selection and iteration statements
— integer constant type rules
— integer promotion rules
— macros with a variable number of arguments
— the **vscanf** family of functions in **<stdio.h>** and **<wchar.h>**
— additional math library functions in **<math.h>**
— floating-point environment access in **<fenv.h>**
— IEC 60559 (also known as IEC 559 or IEEE arithmetic) support
— trailing comma allowed in **enum** declaration
— **%lf** conversion specifier allowed in **printf**
— inline functions
— the **snprintf** family of functions in **<stdio.h>**
— boolean type in **<stdbool.h>**
— idempotent type qualifiers
— empty macro arguments

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— new struct type compatibility rules (tag compatibility)

— additional predefined macro names

— **`_Pragma`** preprocessing operator

— standard pragmas

— **`__func__`** predefined identifier

— **`VA_COPY`** macro

— additional **`strftime`** conversion specifiers

— LIA compatibility annex

— deprecate **`ungetc`** at the beginning of a binary file

— remove deprecation of aliased array parameters

— conversion of array to pointer not limited to lvalues

— relaxed constraints on aggregate and union initialization

— relaxed restrictions on portable header names

— **`return`** without expression not permitted in function that returns a value (and vice versa)

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6 Annexes D and F form a normative part of this standard; annexes A, B, C, E, G, H, I, J, the bibliography, and the index are for information only. In accordance with Part 3 of the ISO/IEC Directives, this foreword, the introduction, notes, footnotes, and examples are also for information only.

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1 With the introduction of new devices and extended character sets, new features may be added to this International Standard. Subclauses in the language and library clauses warn implementors and programmers of usages which, though valid in themselves, may conflict with future additions.

2 Certain features are *obsolescent*, which means that they may be considered for withdrawal in future revisions of this International Standard. They are retained because of their widespread use, but their use in new implementations (for implementation features) or new programs (for language [6.11] or library features [7.26]) is discouraged.

3 This International Standard is divided into four major subdivisions:

— preliminary elements (clauses 1−4);

— the characteristics of environments that translate and execute C programs (clause 5);

— the language syntax, constraints, and semantics (clause 6);

— the library facilities (clause 7).

4 Examples are provided to illustrate possible forms of the constructions described. Footnotes are provided to emphasize consequences of the rules described in that subclause or elsewhere in this International Standard. References are used to refer to other related subclauses. Recommendations are provided to give advice or guidance to implementors. Annexes provide additional information and summarize the information contained in this International Standard. A bibliography lists documents that were referred to during the preparation of the standard.

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5 The language clause (clause 6) is derived from ‘‘The C Reference Manual’’.

6 The library clause (clause 7) is based on the *1984 /usr/group Standard*.

1 This International Standard specifies the form and establishes the interpretation of programs written in the C programming language.[1)] It specifies

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— the representation of C programs;

— the syntax and constraints of the C language;

— the semantic rules for interpreting C programs;

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— the representation of input data to be processed by C programs;

— the representation of output data produced by C programs;

— the restrictions and limits imposed by a conforming implementation of C.

2 This International Standard does not specify

— the mechanism by which C programs are transformed for use by a data-processing system;

— the mechanism by which C programs are invoked for use by a data-processing system;

— the mechanism by which input data are transformed for use by a C program;

— the mechanism by which output data are transformed after being produced by a C program;

1) This International Standard is designed to promote the portability of C programs among a variety of data-processing systems. It is intended for use by implementors and programmers.