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Programming languages - C++

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Foreword

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

This fifth edition cancels and replaces the fourth edition (ISO/IEC 14882:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— expression evaluation order is specified in more cases

— removal of trigraphs

— adjustments to value categories resulting in copy elision being mandatory

— additional character and floating point literal syntaxes

— lambda expressions extended to permit capture of `*this` and use in constant expressions

— initializer statements for `if` and `switch` statements

— addition of constexpr if statements

— range-based `for` statement generalized to support heterogeneous `begin` and `end` types

— addition of structured bindings

— addition of inline variables

— list initialization extended to support enumerations and aggregates with base classes

— message in `static_assert` is now optional

— addition of nested namespace definition syntax

- extended support for attributes
- exception specifications are now part of function types
- template argument deduction is now supported for class templates
- addition of fold expressions
- pack expansion can be performed on using declarations
- permitted forms of template parameters and template arguments have been generalized
- dynamic allocation is supported for over-aligned types
- preprocessor can detect presence of header files with `__has_include`
- new utility functions, types, and templates in the standard library, including
  - an `any` type
  - an `optional` class template
  - a `variant` class template
  - a `clamp` function
  - a `std::byte` type
  - a `not_fn` function
  - a `void_t` alias template
  - `conjunction`, `disjunction`, and `negation` templates
  - an `invoke` function, and `is_invocable` and `invoke_result` type traits
  - an `is_swappable` type trait
- extended constant expression evaluation support in the standard library
- elementary conversion functions between strings and numeric types added
- constructors for `pair` and `tuple` are conditionally-explicit
- `shared_ptr`s of array types now supported
- additional algorithms for managing uninitialized memory
- addition of polymorphic memory resources
- addition of substring search facilities providing the Boyer-Moore and Boyer-Moore-Horspool search algorithms
- addition of variable templates for type traits
- addition of a non-owning string view template
- ability to splice elements between containers for maps and sets
- better support for element insertion in unique-key maps
- support for incomplete types in containers
- addition of parallel algorithms
- addition of `sample` algorithm
- addition of mathematical special functions, and `gcd`, `lcm`, and three-argument `hypot` functions
- addition of support for operations on file systems
- addition of shared mutexes and variadic lock guards
- removal of deprecated features