S.4.4c — Using a language reference

BY NASCARDRIVER ON JANUARY 30TH, 2020 | LAST MODIFIED BY NASCARDRIVER ON JANUARY 30TH, 2020

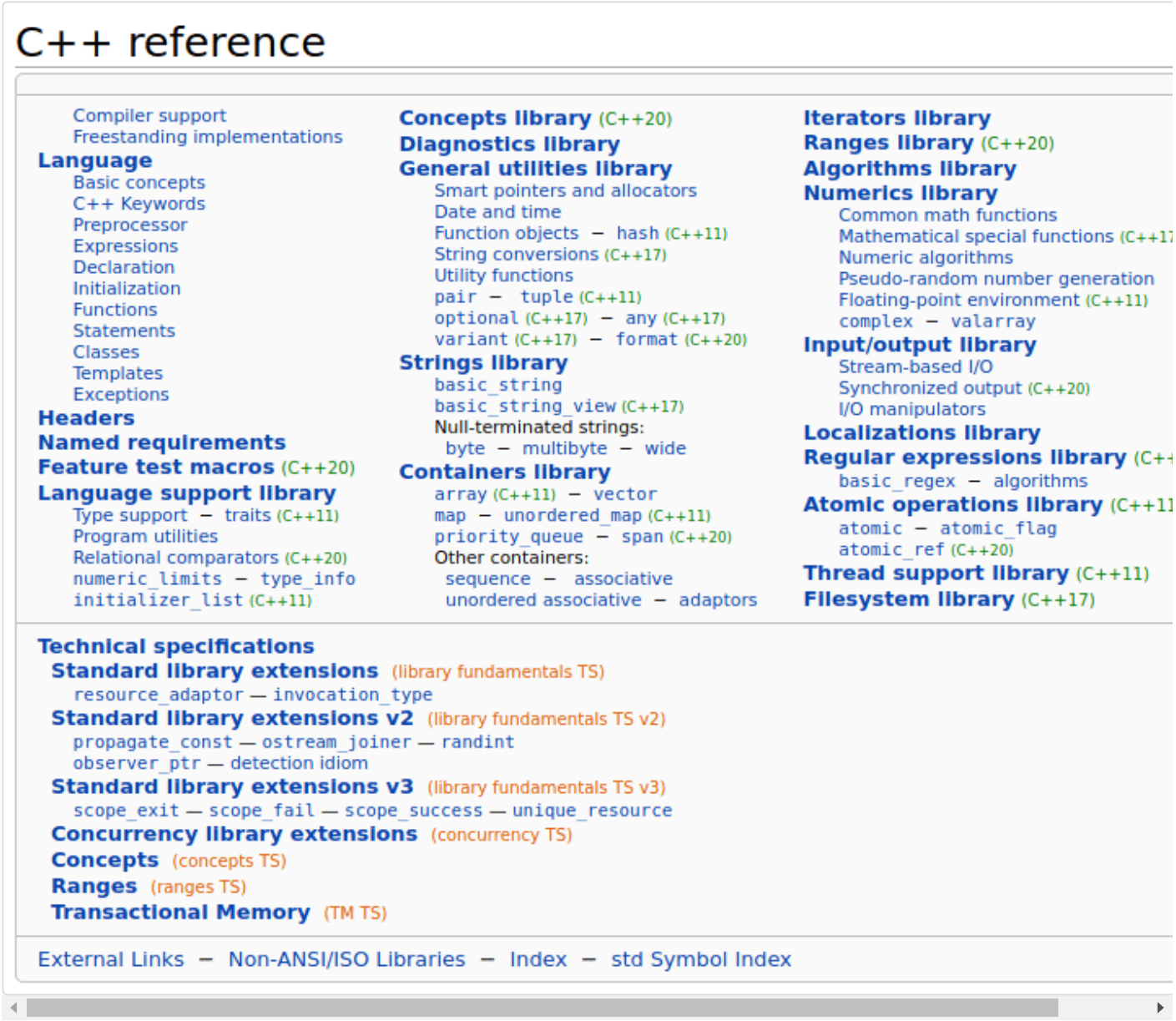
Depending on where you're at in your journey with learning programming languages (and specifically, C++), LearnCpp.com might be the only resource you're using to learn C++ or to look something up. LearnCpp.com is designed to explain concepts in a beginner-friendly fashion, but it simply can't cover every aspect of the language. As you begin to explore outside the topics that these tutorials cover, you'll inevitably run into questions that these tutorials don't answer. In that case, you'll need to leverage outside resources.

One such resource is **Stack Overflow**, where you can ask questions (or better, read the answer to the same question someone before you asked). But sometimes a better first stop is a reference guide. Unlike tutorials, which are designed to describe part of the language using informal language, reference guides describe the language using formal language. Because of this, reference material tends to be comprehensive, accurate, and... hard to understand.

In this lesson, we'll show how to use **cppreference**, a popular standard reference that we refer to throughout the lessons, by researching 3 examples.

Overview

Cppreference greets you with an **overview** of the core language and libraries:



From here, you can get to everything cppreference has to offer, but it's easier to use the search function, or a search engine. The overview is a great place to visit once you've finished the tutorials on LearnCpp.com, to delve deeper into the libraries, and to see what else the language has to offer that you might not be aware of.

The upper half of the table shows features currently in the language, while the bottom half shows technical specifications, which are features that may or may not be added to C++ in a future version, or have already been partially accepted into the language. This can be useful if you want to see what new capabilities are coming soon.

Starting with C++11, cppreference marks all features with the language standard version they've been added in. The standard version is the little green number you can see next to some of the links in the above image. Features without a version number have been available since C++98/03. The version numbers are not only in the overview, but everywhere on cppreference, letting you know exactly what you can or cannot use in a specific C++ version.

A reminder

The C++ versions are C++98, C++03, C++11, C++14, C++17, (in-progress C++20).

Warning

If you use a search engine and a technical specification has just been accepted into the standard, you might get linked to a technical specification rather than the official reference, which can differ.

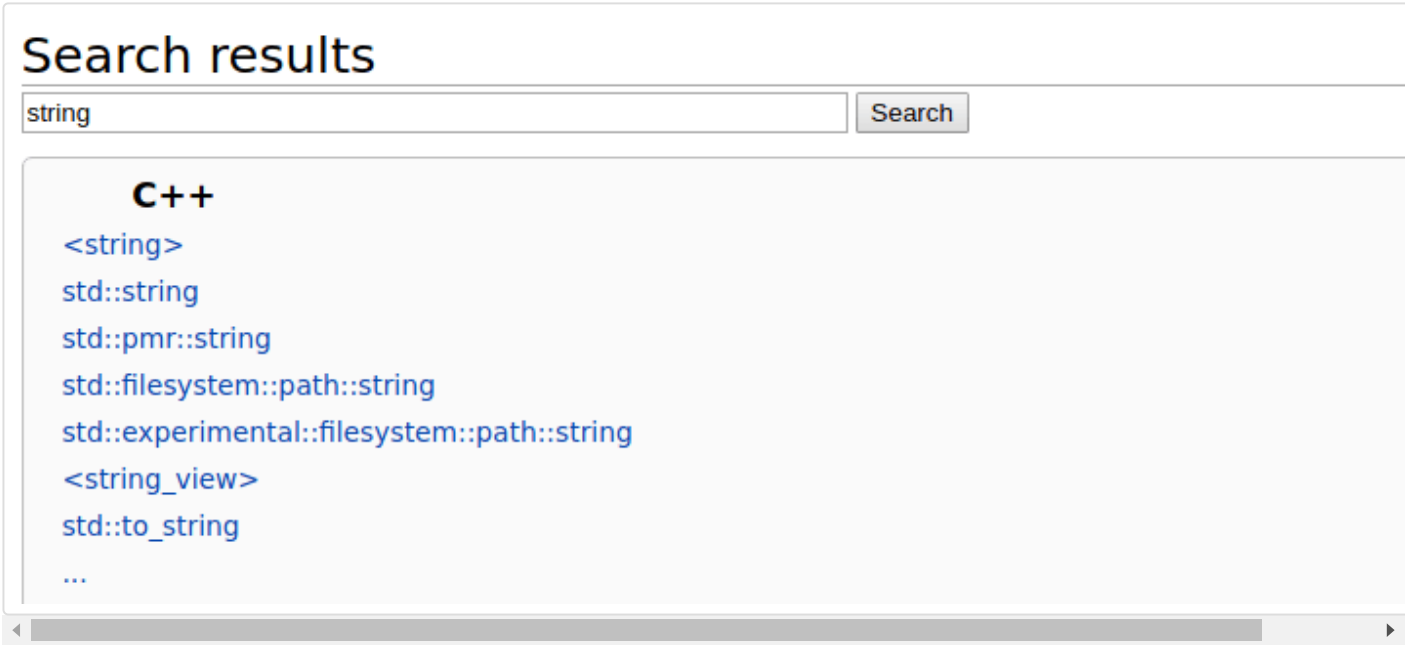
Tip

Cppreference is not only a reference for C++, but also for C. Since C++ shares some functions with C (which can differ), you may find yourself in the C reference after searching for something. The URL and the navigation bar at the top of cppreference always show you if you're browsing the C or C++ reference.

std::string::length

We'll start by researching a function that you know from the previous lesson, `std::string::length`, which returns the length of a string.

On the top right of cppreference, search for "string". Doing so shows a long list of types and functions, of which only the top is relevant for now.



We could have searched for "string length" right away, but for the purpose of showing as much as possible in this lesson, we're taking the long route. Clicking on "std::string" leads to **`std::basic_string`**. There is no page for `std::string`, because `std::string` is a `typedef` for `std::basic_string<char>`, which can be seen in the `typedef` list:

Type	Definition
std::string	std::basic_string<char>
std::wstring	std::basic_string<wchar_t>
std::u8string (C++20)	std::basic_string<char8_t>
std::u16string (C++11)	std::basic_string<char16_t>
std::u32string (C++11)	std::basic_string<char32_t>
std::pmr::string (C++17)	std::pmr::basic_string<char>
std::pmr::wstring (C++17)	std::pmr::basic_string<wchar_t>
std::pmr::u8string (C++20)	std::pmr::basic_string<char8_t>
std::pmr::u16string (C++17)	std::pmr::basic_string<char16_t>
std::pmr::u32string (C++17)	std::pmr::basic_string<char32_t>

The <char> means that each character of the string is of type char. You'll note that C++ offers other strings that use different character types. These can be useful when using Unicode instead of ASCII.

Further down the same page, there's a **list of member functions** (the behaviors that a type has). If you want to know what you can do with a type, this list is very convenient. In this list, you'll find a row for length (and size).

Following the link brings us to the detailed function description of **length and size**, which both do the same thing.

The top of each page starts with a short summary of the feature and syntax, overloads, or declarations:

std::basic_string<CharT,Traits,Allocator>::size,
std::basic_string<CharT,Traits,Allocator>::length

```
size_type size() const;              (until C++11)
size_type size() const noexcept;     (since C++11)
size_type length() const;            (until C++11)
size_type length() const noexcept;   (since C++11)
```

Returns the number of CharT elements in the string, i.e. std::distance(begin(), end()).

The title of the page shows the name of the class and function with all template parameters. We can ignore this part. Below the title, we see all of the different function overloads (different versions of the function that share the same name) and which language standard they apply to.

Below that, we can see the parameters that the function takes, and what the return value means.

Because std::string::length is a simple function, there's not a lot of content on this page. Many pages show example uses of the feature they're documenting, as does this one:

Example

Run this code

```
#include <cassert>
#include <iterator>
#include <string>

int main()
{
    std::string s("Exemplar");
    assert(8 == s.size());
    assert(s.size() == s.length());
    assert(s.size() == static_cast<std::string::size_type>(
        std::distance(s.begin(), s.end())));

    std::u32string a(U"□□□□□□□□"); // 8 code points
    assert(8 == a.size()); // 8 code units in UTF-32

    std::u16string b(u"□□□□□□□□"); // 8 code points
    assert(8 == b.size()); // 8 code units in UTF-16

    std::string c(u8"□□□□□□□□"); // 8 code points
    assert(24 == c.size()); // 24 code units in UTF-8
}
```

Until you're done learning C++, there will be features in the examples that you haven't seen before. If there are enough examples, you're probably able to understand a sufficient amount of it to get an idea of how the function is used and what it does. If the example is too complicated, you can search for an example somewhere else or read the reference of the parts you don't understand (you can click on functions and types in the examples to see what they do).

Now we know what `std::string::length` does, but we knew that before. Let's have a look at something new!

---

std::cin.ignore

In lesson **S.4.4b -- An introduction to std::string**, we talked about `std::cin.ignore`, which is used to ignore everything up to a line break. One of the parameters of this function is some long and verbose value. What was that again? Can't you just use a big number? What does this argument do anyway? Let's figure it out!

The search function on cppreference doesn't find anything when we search for "std::cin.ignore", let's try our favorite search engine:

std::ignore - cppreference.com
https://en.cppreference.com/w/cpp/utility/tuple/ignore
unpack a pair returned by set.insert(), but only save the boolean.

std::basic_istream<CharT,Traits>::ignore - cppreference.com
https://en.cppreference.com/w/cpp/io/basic_istream/ignore
Extracts and discards characters from the input stream until and including delim.. ignore behaves as an UnformattedInputFunction.After constructing and checking the sentry object, it extracts characters from the stream and discards them until any one of the following conditions occurs:

std::cin, std::wcin - cppreference.com
https://en.cppreference.com/w/cpp/io/cin
The global objects std::cin and std::wcin control input from a stream buffer of implementation-defined type (derived from std::streambuf), associated with the standard C input stream stdin.. These objects are guaranteed to be initialized during or before the first time an object of type std::ios_base::Init is constructed and are available for use in the constructors and destructors of static ...

std::getline - cppreference.com
https://en.cppreference.com/w/cpp/string/basic_string/getline
Return value. input [] NoteWhen consuming whitespace-delimited input (e.g. int n; std:: cin >> n;) any whitespace that follows, including a newline character, will be left on the input stream.Then when switching to line-oriented input, the first line retrieved with getline will be just that whitespace. In the likely case that this is unwanted behaviour, possible solutions include:

- `std::ignore` - No, that's not it.
- `std::basic_istream::ignore` - Eew, no.
- `std::cin` - We want `.ignore`, not plain `std::cin`.
- `std::getline` - That's not it either.

It's not there, what now? Let's go to **`std::cin`** and work our way from there. There's nothing immediately obvious on that page. On the top, we can see the declaration of `std::cin` and `std::wcin`, and it tells us which header we need to include to use `std::cin`:

std::cin, std::wcin

Defined in header <iostream>

```
extern std::istream cin;      (1)
extern std::wistream wcin;    (2)
```

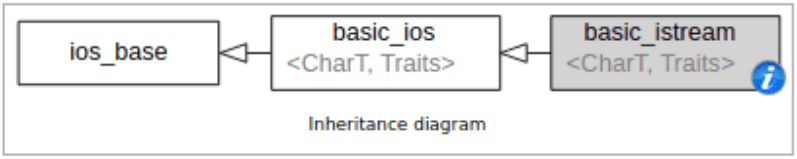
We can see that `std::cin` is an object of type `std::istream`. Let's follow the link to **`std::istream`**:

std::basic_istream

Defined in header <istream>

```
template<
    class CharT,
    class Traits = std::char_traits<CharT>
> class basic_istream : virtual public std::basic_ios<CharT, Traits>
```

The class template basic_istream provides support for high level input operations on character streams. The supported operations include formatted input (e.g. integer values or whitespace-separated characters and ch strings) and unformatted input (e.g. raw characters and character arrays). This functionality is implemented i of the interface provided by the underlying basic_streambuf class, accessed through the basic_ios base cl only non-inherited data member of basic_istream, in most implementations, is the value returned by basic_istream::gcount().



Two specializations for common character types are defined:

Defined in header <istream>

Type	Definition
istream	basic_istream<char>
wistream	basic_istream<wchar_t>

Global objects

Two global basic_istream objects are provided by the standard library.

Defined in header <iostream>

cin reads from the standard C input stream stdin
wcin (global object)

Hold up! We've seen `std::basic_istream` before when we searched for "std::cin.ignore" in our search engine. It turns out that `istream` is a typedef for `basic_istream`, so maybe our search wasn't so wrong after all.

Scrolling down on that page, we're greeted with familiar functions:

Member functions

(constructor)	constructs the object (public member function)
(destructor) [virtual]	destructs the object (virtual public member function)
operator= (C++11)	move-assigns from another basic_istream (protected member function)

Formatted input

operator>>	extracts formatted data (public member function)

Unformatted input

get	extracts characters (public member function)
peek	reads the next character without extracting it (public member function)
unget	unextracts a character (public member function)
putback	puts character into input stream (public member function)
getline	extracts characters until the given character is found (public member function)
ignore	extracts and discards characters until the given character is found (public member function)
read	extracts blocks of characters (public member function)
readsome	extracts already available blocks of characters (public member function)
gcount	returns number of characters extracted by last unformatted input operation (public member function)

Positioning

tellg	returns the input position indicator (public member function)
seekg	sets the input position indicator (public member function)

Miscellaneous

sync	synchronizes with the underlying storage device (public member function)
swap (C++11)	swaps stream objects, except for the associated buffer (protected member function)

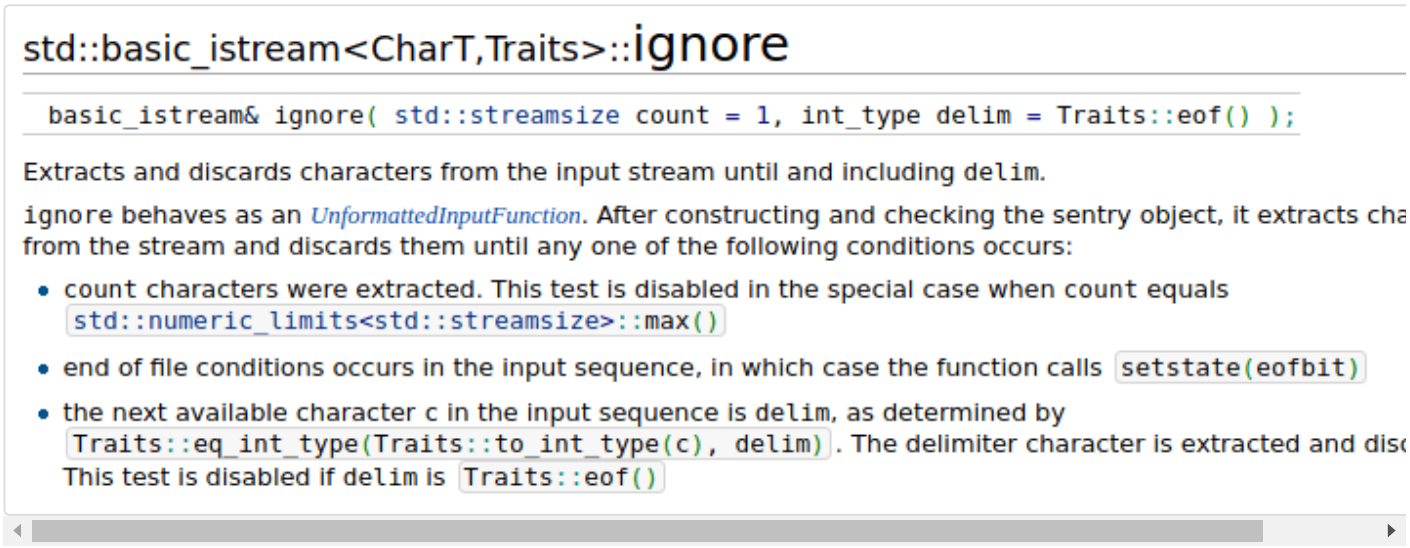
Member classes

sentry	implements basic logic for preparation of the stream for input operations (public member class)

Non-member functions

operator>> (std::basic_istream)	extracts characters and character arrays (function template)

We've used many of these functions already: `operator>>`, `get`, `getline`, `ignore`. Scroll around on that page to get an idea of what else there is in `std::cin`. Then click **`ignore`**, since that's what we're interested in.



std::basic_istream<CharT,Traits>::ignore

```
basic_istream& ignore( std::streamsize count = 1, int_type delim = Traits::eof() );
```

Extracts and discards characters from the input stream until and including delim.

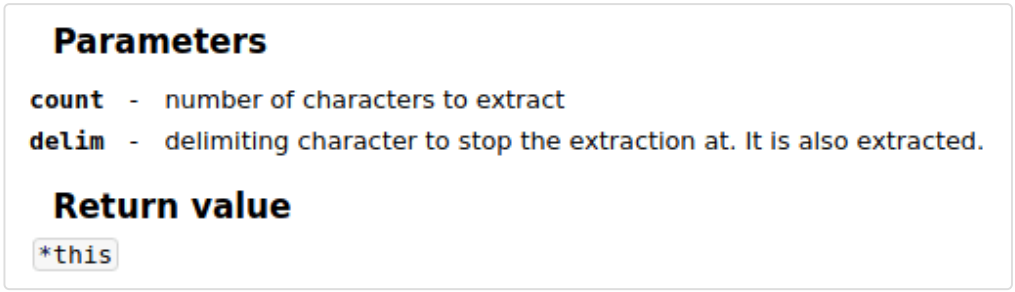
ignore behaves as an *UnformattedInputFunction*. After constructing and checking the sentry object, it extracts cha from the stream and discards them until any one of the following conditions occurs:

- count characters were extracted. This test is disabled in the special case when count equals std::numeric_limits<std::streamsize>::max()
- end of file conditions occurs in the input sequence, in which case the function calls setstate(eofbit)
- the next available character c in the input sequence is delim, as determined by Traits::eq_int_type(Traits::to_int_type(c), delim). The delimiter character is extracted and disc This test is disabled if delim is Traits::eof()

On the top of the page there's the function signature and a description of what the function and its two parameters do. The = signs after the parameters indicate a **default argument** (we cover this in lesson **7.7 -- Default arguments**). If we don't provide an argument for a parameter that has a default value, the default value is used.

The first bullet point answers all of our questions. We can see that `std::numeric_limits<std::streamsize>::max()` has special meaning to `std::cin.ignore`, in that it disables the character count check. This means `std::cin.ignore` will continue ignoring characters until it finds the delimiter, or until it runs out of characters to look at.

Many times, you don't need to read the entire description of a function if you already know it but forgot what the parameters or return value mean. In such situations, reading the parameter or return value description suffices.



Parameters

count - number of characters to extract

delim - delimiting character to stop the extraction at. It is also extracted.

Return value

*this

The parameter description is brief. It doesn't contain the special handling of `std::numeric_limits<std::streamsize>::max()` or the other stop conditions, but serves as a good reminder.

A language grammar example

Alongside the standard library, cppreference also documents the language grammar. Here's a valid program:

```
1  #include <iostream>
2
3  int getUserInput()
4  {
5    int i{};
6    std::cin >> i;
7    return i;
8  }
9
10 int main()
11 {
```

```
12    std::cout << "How many bananas did you eat today? \n";
13
14    if (int iBananasEaten{ getUserInput() }; iBananasEaten <= 2)
15    {
16      std::cout << "Yummy\n";
17    }
18    else
19    {
20      std::cout << iBananasEaten << " is a lot!\n";
21    }
22
23    return 0;
24  }
```

Why is there a variable definition inside the condition of the `if-statement`? Let's use cppreference to figure out what it does by searching for "cppreference if statement" in our favorite search engine. Doing so leads us to **if statements**. At the top, there's a syntax reference.

Syntax

attr(optional) **if** (*condition*) *statement-true* (un C+

attr(optional) **if** (*condition*) *statement-true* **else** *statement-false* (un C+

attr(optional) **if constexpr**(optional) (*init-statement*(optional) *condition*) *statement-true* (sin C+

attr(optional) **if constexpr**(optional) (*init-statement*(optional) *condition*) *statement-true* **else** *statement-false* (sin C+

attr(C++11) - any number of attributes

condition - one of
- expression which is contextually convertible to bool
- declaration of a single non-array variable with a brace-or-equals initializer.

init-statement(C++17) - either
- an expression statement (which may be a *null statement* ";")
- a simple declaration, typically a declaration of a variable with initializer, but it declare arbitrary many variables or be a decomposition declaration

  Note that any *init-statement* must end with a semicolon **;**, which is why it is of described informally as an expression or a declaration followed by a semicolon

statement-true - any statement (often a compound statement), which is executed if *condition* evalu to `true`

statement-false - any statement (often a compound statement), which is executed if *condition* evalu to `false`

On the right, we can again see the version for which this syntax is relevant. Look at the version of the `if-statement` that is relevant since C++17. If you remove all of the optional parts, you get an `if-statement` that you already know. Before the `condition`, there's an optional `init-statement`, that looks like what's happening in the code above.

```
if ( init-statement condition ) statement-true
if ( init-statement condition ) statement-true else statement-false
```

Below the syntax reference, there's an explanation of each part of the syntax, including the `init-statement`. It says that the `init-statement` is typically a declaration of a variable with an initializer.

Following the syntax is an explanation of `if-statements` and simple examples:

Explanation

If the *condition* yields `true` after conversion to `bool`, *statement-true* is executed.

If the else part of the if statement is present and *condition* yields `false` after conversion to `bool`, *statemer* executed.

In the second form of if statement (the one including else), if *statement-true* is also an if statement then that statement must contain an else part as well (in other words, in nested if-statements, the else is associated wi closest if that doesn't have an else)

Run this code

```
#include <iostream>

int main() {
    // simple if-statement with an else clause
    int i = 2;
    if (i > 2) {
        std::cout << i << " is greater than 2\n";
    } else {
        std::cout << i << " is not greater than 2\n";
    }

    // nested if-statement
    int j = 1;
    if (i > 1)
        if (j > 2)
            std::cout << i << " > 1 and " << j << " > 2\n";
        else // this else is part of if (j > 2), not of if (i > 1)
            std::cout << i << " > 1 and " << j << " <= 2\n";

   // declarations can be used as conditions with dynamic_cast
   struct Base {
        virtual ~Base() {}
   };
   struct Derived : Base {
       void df() { std::cout << "df()\n"; }
   };
   Base* bp1 = new Base;
   Base* bp2 = new Derived;

   if (Derived* p = dynamic_cast<Derived*>(bp1)) // cast fails, returns nullptr
       p->df();  // not executed

   if (auto p = dynamic_cast<Derived*>(bp2)) // cast succeeds
       p->df();  // executed
}
```

Output:

```
2 is not greater than 2
2 > 1 and 1 <= 2
df()
```

We already know how `if-statements` work, and the examples don't include an `init-statement`, so we scroll down a little to find a section dedicated to `if-statements` with initializers:

If Statements with Initializer

If *init-statement* is used, the if statement is equivalent to

```
{
    init_statement
    if constexpr(optional) ( condition )
        statement-true
}
```

or

```
{
    init_statement
    if constexpr(optional) ( condition )
        statement-true
    else
        statement-false
}
```

Except that names declared by the *init-statement* (if *init-statement* is a declaration) and names declared by *condition* (if condition is a declaration) are in the same scope, which is also the scope of both *statement*s.

```
std::map<int, std::string> m;
std::mutex mx;
extern bool shared_flag; // guarded by mx
int demo() {
    if (auto it = m.find(10); it != m.end()) { return it->second.size(); }
    if (char buf[10]; std::fgets(buf, 10, stdin)) { m[0] += buf; }
    if (std::lock_guard lock(mx); shared_flag) { unsafe_ping(); shared_flag = false; }
    if (int s; int count = ReadBytesWithSignal(&s)) { publish(count); raise(s); }
    if (auto keywords = {"if", "for", "while"};
        std::any_of(keywords.begin(), keywords.end(),
                    [&s](const char* kw) { return s == kw; })) {
      std::cerr << "Token must not be a keyword\n";
    }
}
```

First, it is shown how the `init-statement` can be written without actually using an `init-statement`. Now we know what the code in question is doing. It's a normal variable declaration, just merged into the `if-statement`.

The sentence after that is interesting, because it let's us know that the names from the `init-statement` are available in *both* statements (`statement-true` and `statement-false`). This may be surprising, since you might otherwise assume the variable is only available in the `statement-true`.

The `init-statement` examples use features and types that we haven't covered yet. You don't have to understand everything you see to understand how the `init-statement` works. Let's skip everything that's too confusing until we find something we can work with:

```
1  // Iterators, we don't know them. Skip.
2  if (auto it = m.find(10); it != m.end()) { return it->second.size(); }
3
4  // [10], what's that? Skip.
5  if (char buf[10]; std::fgets(buf, 10, stdin)) { m[0] += buf; }
6
7  // std::lock_guard, we don't know that, but it's some type. We know what types are!
```

```
if (std::lock_guard lock(mx); shared_flag) { unsafe_ping(); shared_flag = false; }

// This is easy, that's an int!
if (int s; int count = ReadBytesWithSignal(&s)) { publish(count); raise(s); }

// Whew, no thanks!
if (auto keywords = {"if", "for", "while"};
    std::any_of(keywords.begin(), keywords.end(),
                [&](const char* kw) { return s == kw; })) {
  std::cerr << "Token must not be a keyword\n";
}
```

The easiest example seems to be the one with an `int`. Then we look after the semicolon and there's another definition, odd... Let's go back to the `std::lock_guard` example.

```
if (std::lock_guard lock(mx); shared_flag)
{
  unsafe_ping();
  shared_flag = false;
}
```

From this, it's relatively easy to see how an `init-statement` works. Define some variable (`lock`), then a semicolon, then the condition. That's exactly what happened in our example.

A warning about the accuracy of cppreference

Cppreference is not an official documentation source -- rather, it is a wiki. With wikis, anyone can add and modify content -- the content is sourced from the community. Although this means that it's easy for someone to add wrong information, that misinformation is typically quickly caught and removed, making cppreference a reliable source.

The only official source for C++ is the **the standard** (Free drafts on **github**), which is a formal document and not easily usable as a reference.

Quiz time

Question #1

What does the following program print? Don't run it, use a reference to figure out what `erase` does.

```
#include <iostream>
#include <string>

int main()
{
  std::string str{ "The rice is cooking" };

  str.erase(4, 11);

  std::cout << str << '\n';

  return 0;
}
```

Tip

When you find `erase` on cppreference, you can ignore the function signatures (2) and (3).

Tip

Indexes in C++ start at 0. The character at index 0 in the string "House" is 'H', at 1 it's 'o', and so on.

Show Solution

Question #2

In the following code, modify `str` so that its value is "I saw a blue car yesterday" without repeating the string. ie. don't do this:

```
str = "I saw a blue car yesterday";
```

You only need to call one function to *replace* "red" with "blue".

```
#include <iostream>
#include <string>

int main()
{
  std::string str{ "I saw a red car yesterday." };

  // ...

  std::cout << str << '\n'; // I saw a blue car yesterday

  return 0;
}
```

Show Hint

Show Hint

Show Hint

Show Hint

Show Solution


S.4.5 -- Enumerated types


Index


S.4.4b -- An introduction to std::string

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3 comments to S.4.4c — Using a language reference

fighter_fish
February 3, 2020 at 7:48 pm · Reply

Wow, thank you!

Sirdavos
February 2, 2020 at 1:36 pm · Reply

Hi NascarDriver,
I think this page is uselful but little bit too long. You can shorten the examples maybe or divide the page 2 different part.
Thx

Omran
February 6, 2020 at 5:57 am · Reply

no need to divide the page into 2 different parts , if you want to divide it , then read the first part of it and save the other one for later or something :)