*Object Oriented Programming by C++*

# Selection & Repetition (1/2)

**Conditional execution and Iteration (Loop)**

2017. 8.

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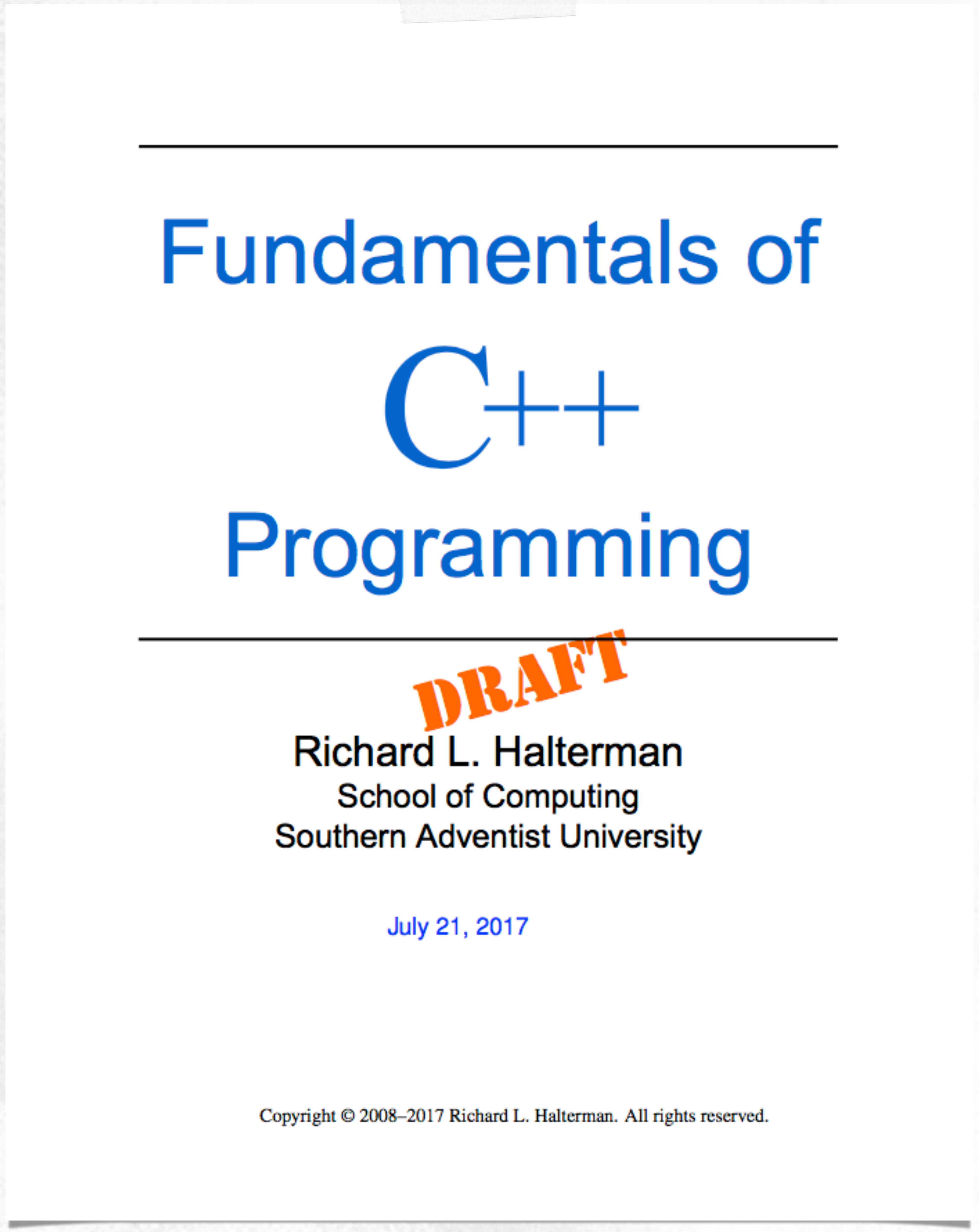
# Textbook & Copyright

- Textbook: http://python.cs.southern.edu/cppbook/progcpp.pdf
- Sample Codes: https://github.com/halterman/CppBook-SourceCode



Fundamentals of C++ Programming

DRAFT

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July 21, 2017

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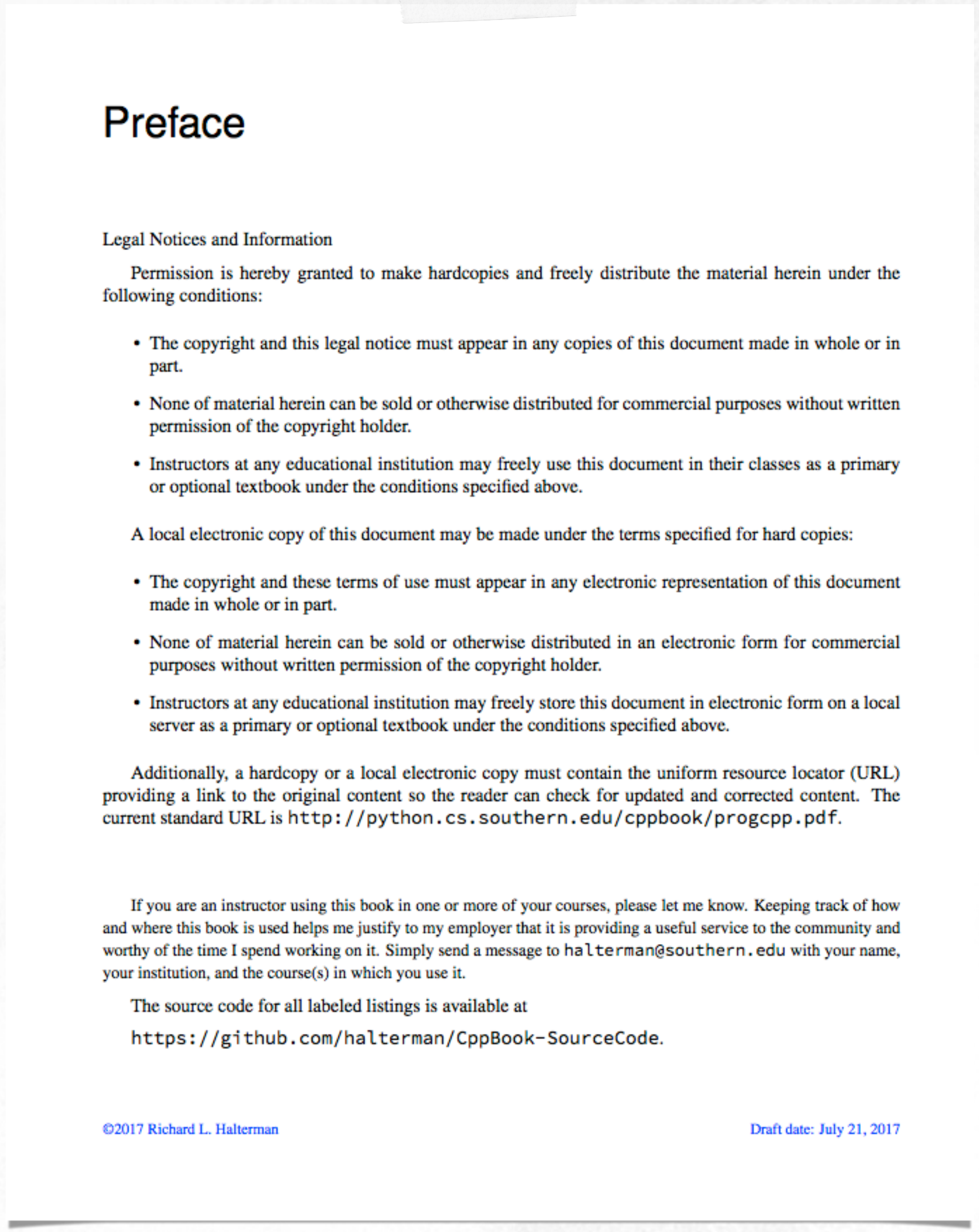

Preface

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The source code for all labeled listings is available at

`https://github.com/halterman/CppBook-SourceCode`.

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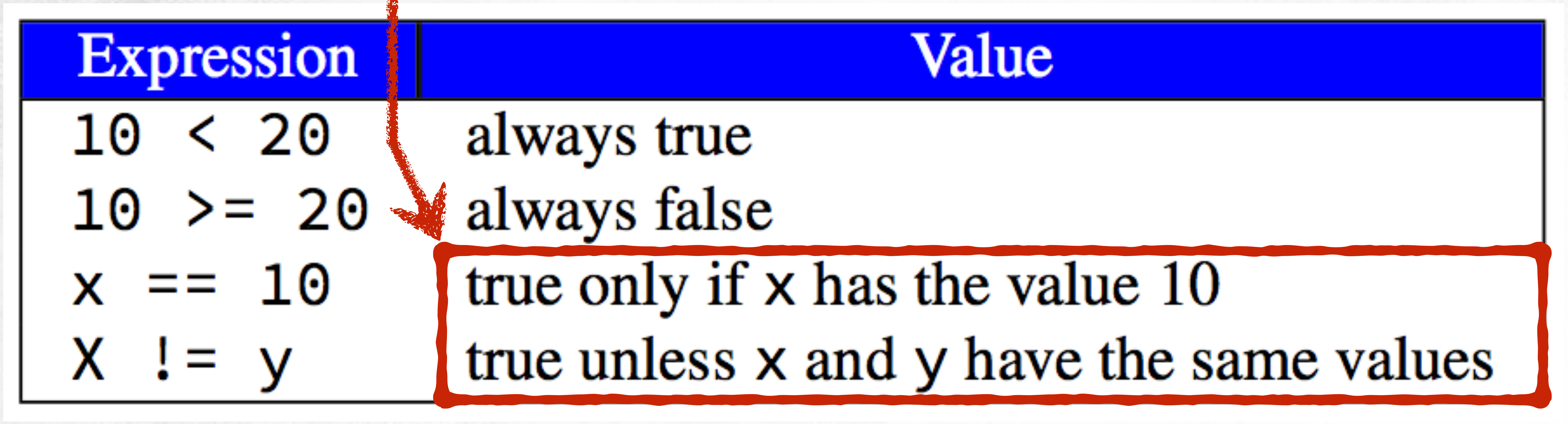
# Contents

Boolean Expression

## True or False

- Conditionally *true* or *false*



| Expression | Value |
|---|---|
| `10 < 20` | always true |
| `10 >= 20` | always false |
| `x == 10` | true only if x has the value 10 |
| `X != y` | true unless x and y have the same values |

Boolean Expression

## Type *bool*

- Special variable type : ***bool***
- ***bool*** type variable can have binary value: ***true*** or ***false*** (constant in C++)

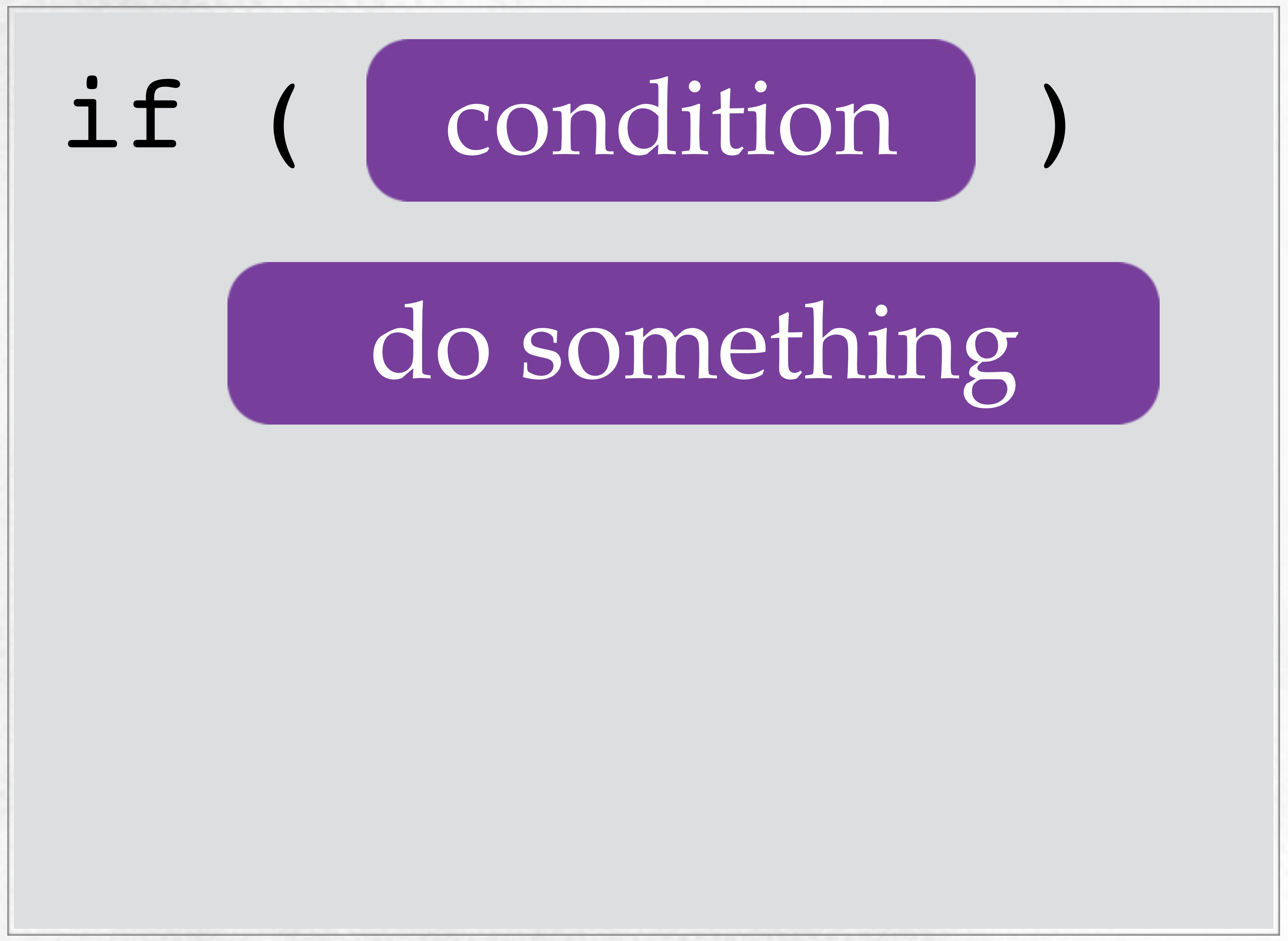
```
#include <iostream>
using namespace std;
int main() {
    bool a = true, b = false;
    std::cout << "(a:b)" << "(" << a << ":" << b <<")";
    return 0;
}
```

```
(a:b)(1:0)
```

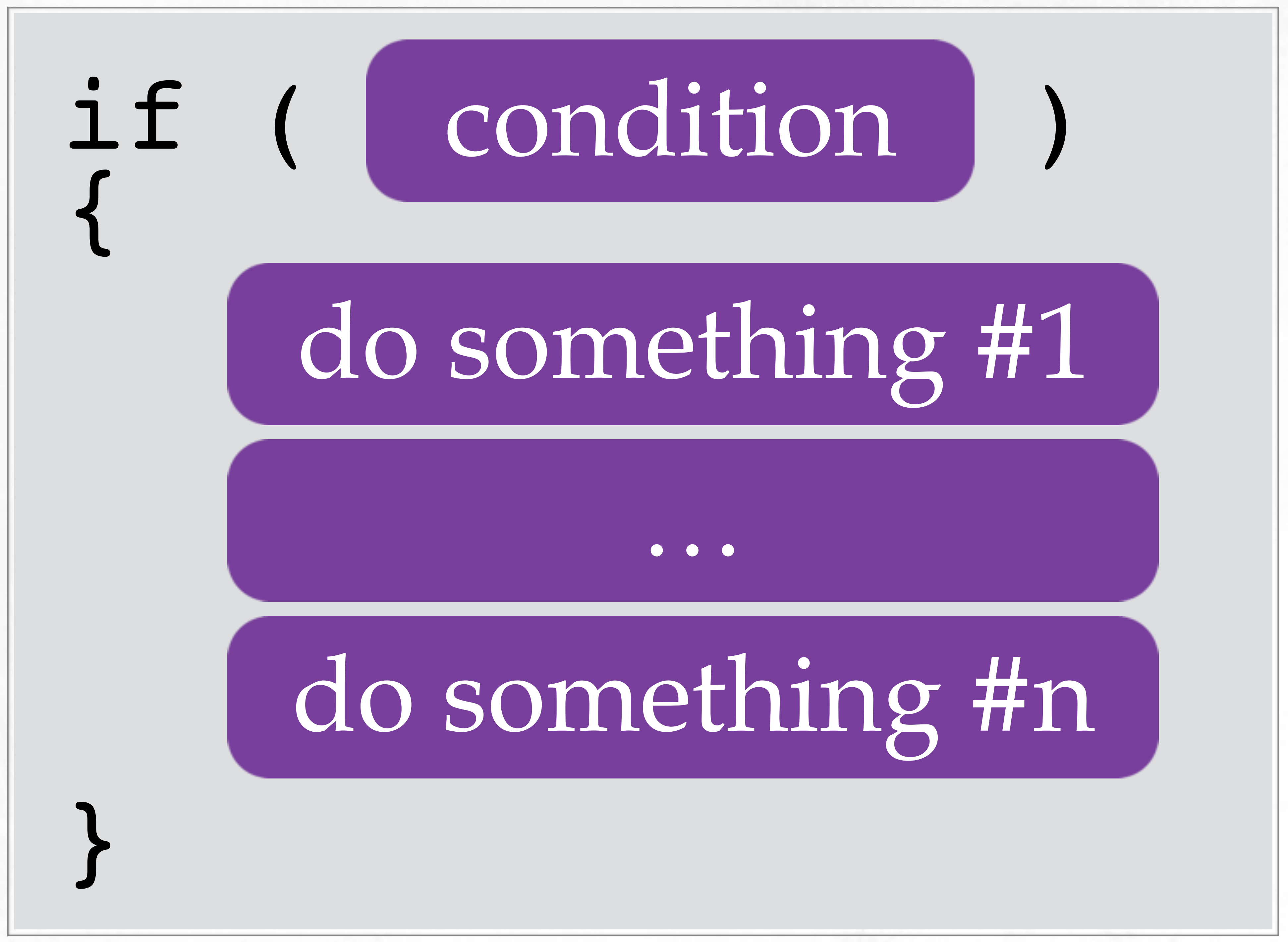
- In C++, ***true*** outputs **1**, and ***false*** outputs ***0***
  - If a variable has ***non-zero value***, it is translated as ***true***

## Simple *if* Statement

- Conditional execution
  - Single statement execution
  - Multiple statement execution



```
if ( condition )
    do something
```



```
if ( condition )
{
    do something #1
    ...
    do something #n
}
```

## Simple *if* Statement Example

**Listing 5.2: betterdivision.cpp**

```cpp
#include <iostream>

int main() {
    int dividend, divisor;

    // Get two integers from the user
    std::cout << "Please enter two integers to divide:";
    std::cin >> dividend >> divisor;
    // If possible, divide them and report the result
    if (divisor != 0)
        std::cout << dividend << "/" << divisor << " = "
                  << dividend/divisor << '\n';
}
```

if (divisor != 0) is true:

```
Please enter two integers to divide: 32 8
32/8 = 4
```

if (divisor != 0) is false:

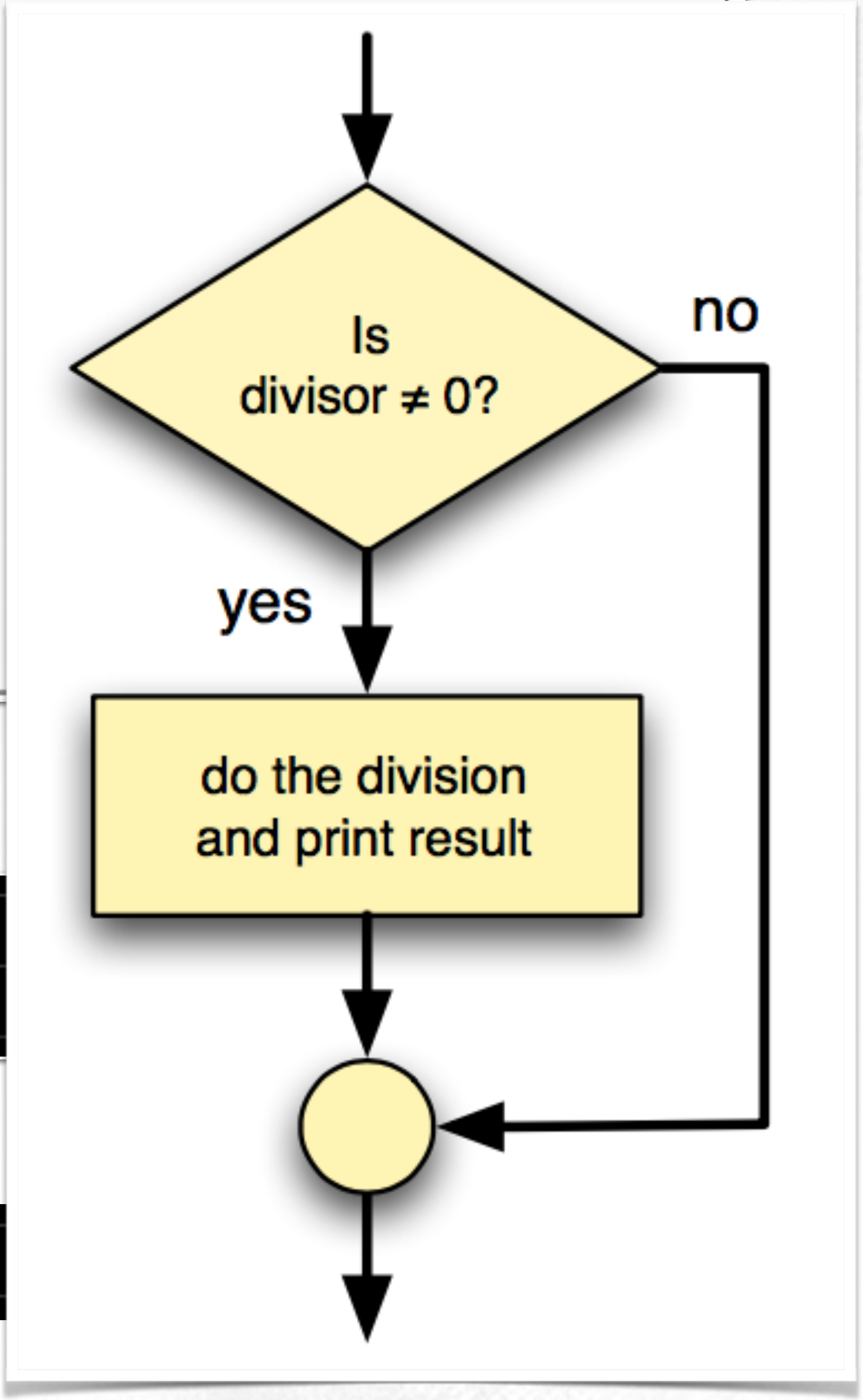
```
Please enter two integers to divide: 32 0
```

if-else statement

## Simple *if* Statement Flow-chart

**Listing 5.2: betterdivision.cpp**

```cpp
#include <iostream>

int main() {
    int dividend, divisor;

    // Get two integers from the user
    std::cout << "Please enter two integers to divide:";
    std::cin >> dividend >> divisor;
    // If possible, divide them and report the result
    if (divisor != 0)
        std::cout << dividend << "/" << divisor << " = "
                  << dividend/divisor << '\n';
}
```



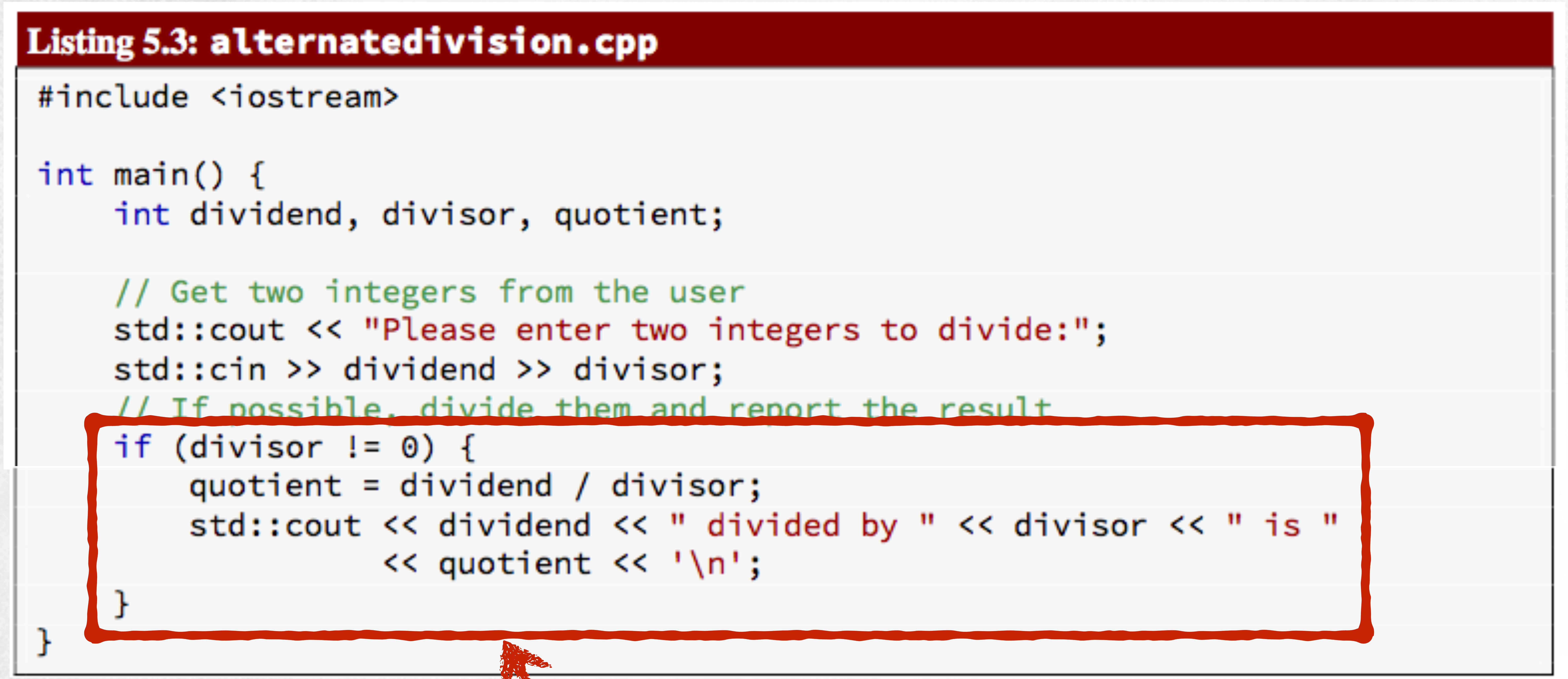
if (divisor != 0) is true:

```
Please enter two integers to divide: 32 8
32/8 = 4
```

if (divisor != 0) is false:

```
Please enter two integers to divide: 32 0
```

## Simple *if* Statement Example



**Listing 5.3: alternatedivision.cpp**

```cpp
#include <iostream>

int main() {
    int dividend, divisor, quotient;

    // Get two integers from the user
    std::cout << "Please enter two integers to divide:";
    std::cin >> dividend >> divisor;
    // If possible, divide them and report the result
    if (divisor != 0) {
        quotient = dividend / divisor;
        std::cout << dividend << " divided by " << divisor << " is "
                  << quotient << '\n';
    }
}
```

Multiple Statement Execution

## Simple *if* Statement Writing

- C++ compiler ignores **space** and **endl**; all following are same

```
if (x < 10)
    y = x;
```

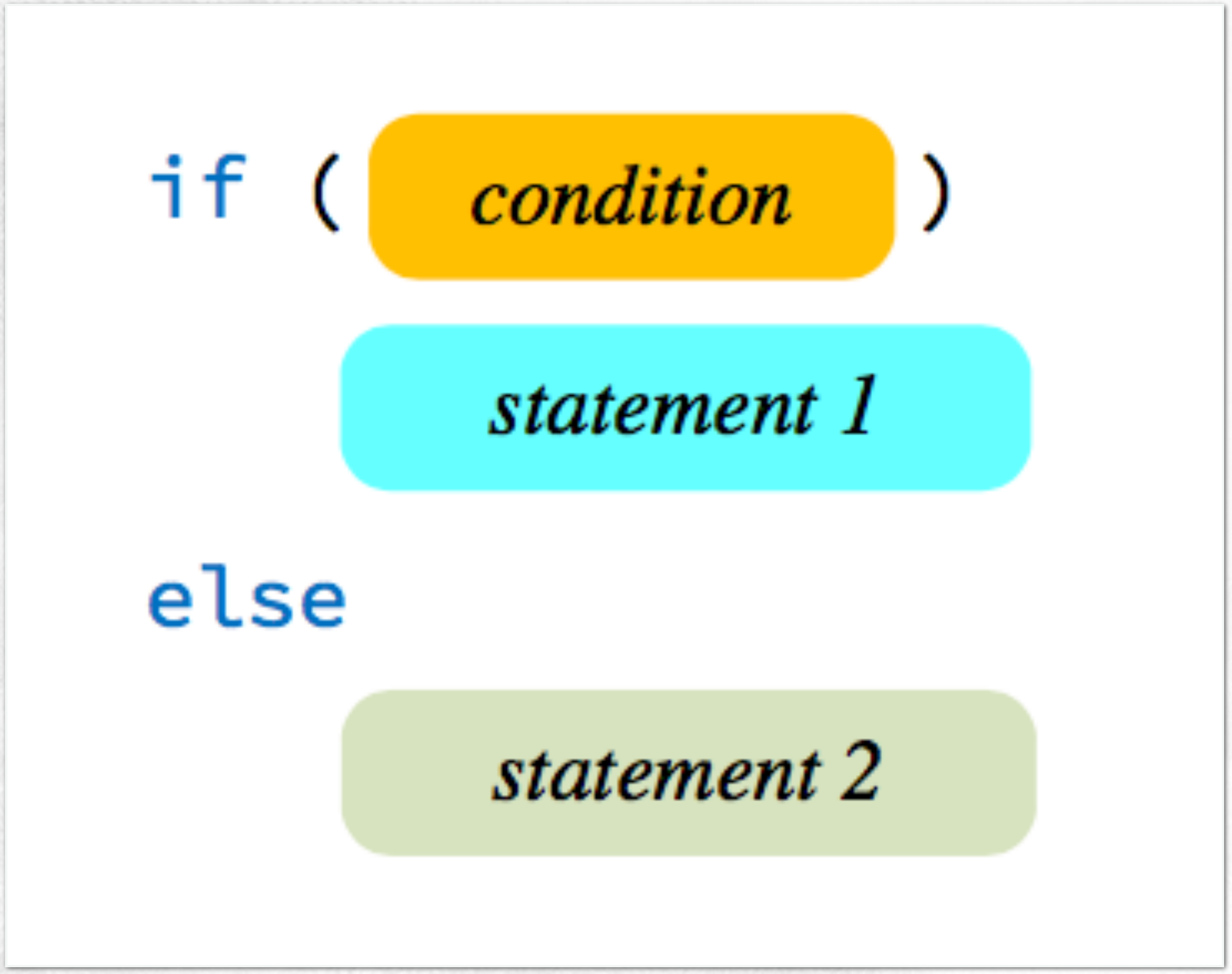
Recommended

```
if (x < 10) y = x;
```

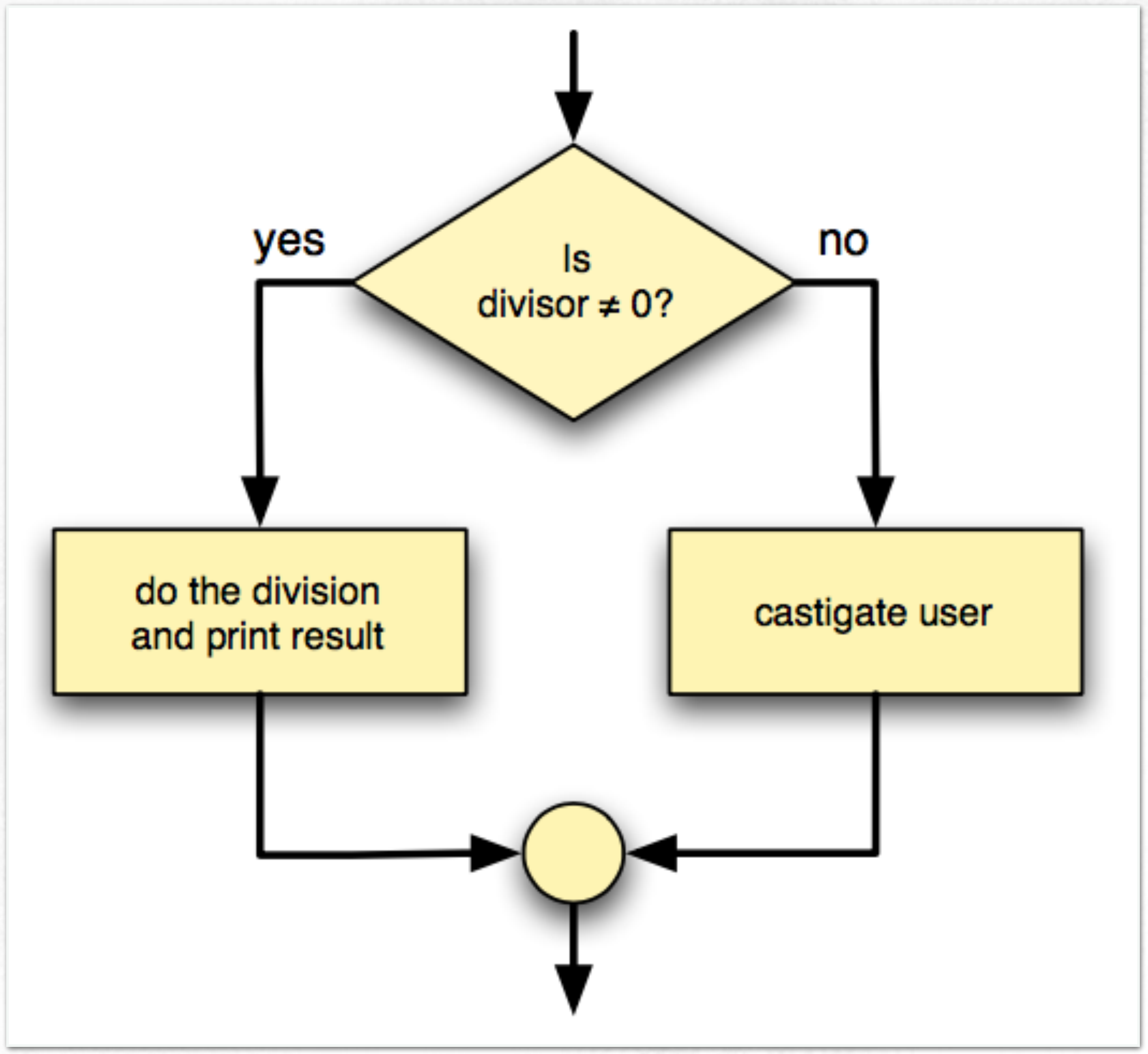
```
if (x < 10)
y = x;
```

## Simple *if-else* Statement

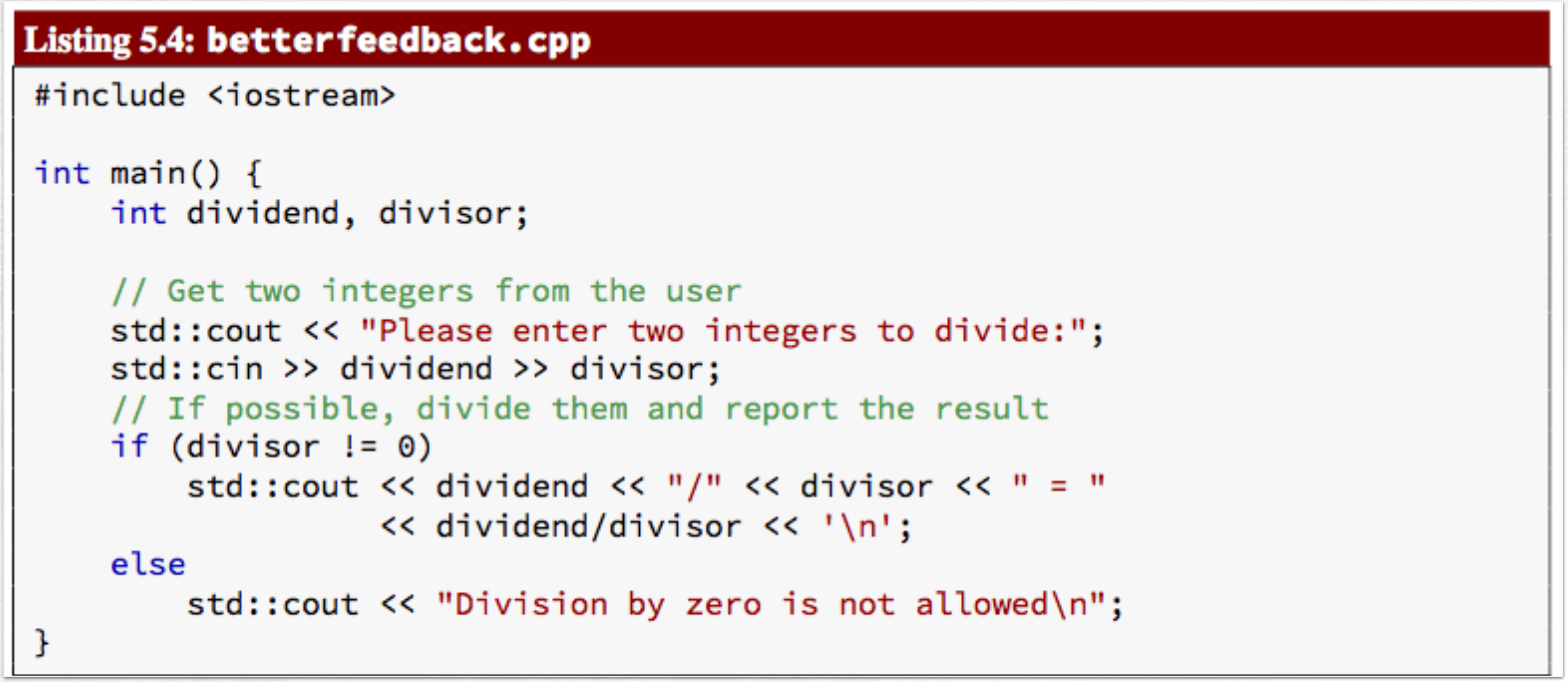
- " *if* you can fly then fly! *else* then walk! "



```
if ( condition )
    statement 1
else
    statement 2
```



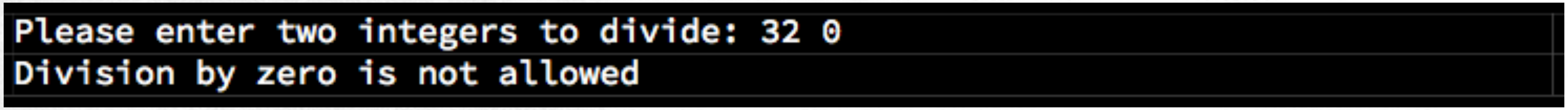
## Simple *if-else* Statement Example



**Listing 5.4: betterfeedback.cpp**

```cpp
#include <iostream>

int main() {
    int dividend, divisor;

    // Get two integers from the user
    std::cout << "Please enter two integers to divide:";
    std::cin >> dividend >> divisor;
    // If possible, divide them and report the result
    if (divisor != 0)
        std::cout << dividend << "/" << divisor << " = "
                  << dividend/divisor << '\n';
    else
        std::cout << "Division by zero is not allowed\n";
}
```

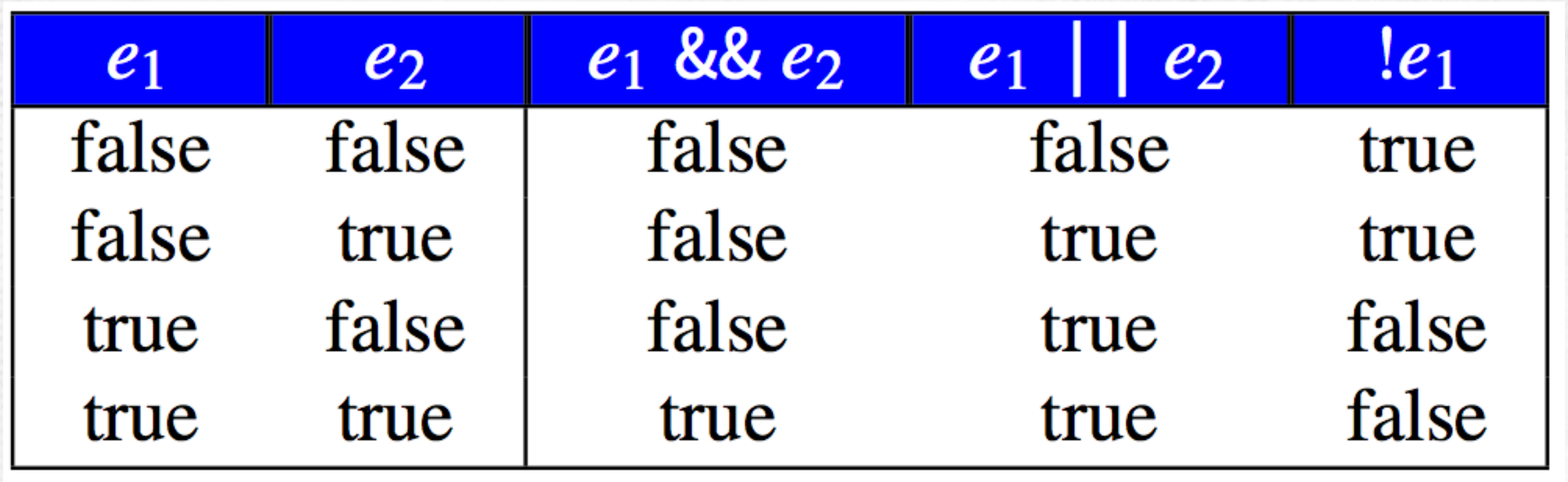
if (divisor != 0) is false:



```
Please enter two integers to divide: 32 0
Division by zero is not allowed
```

if-else statement

## Logical Operator (AND, OR, NOT)

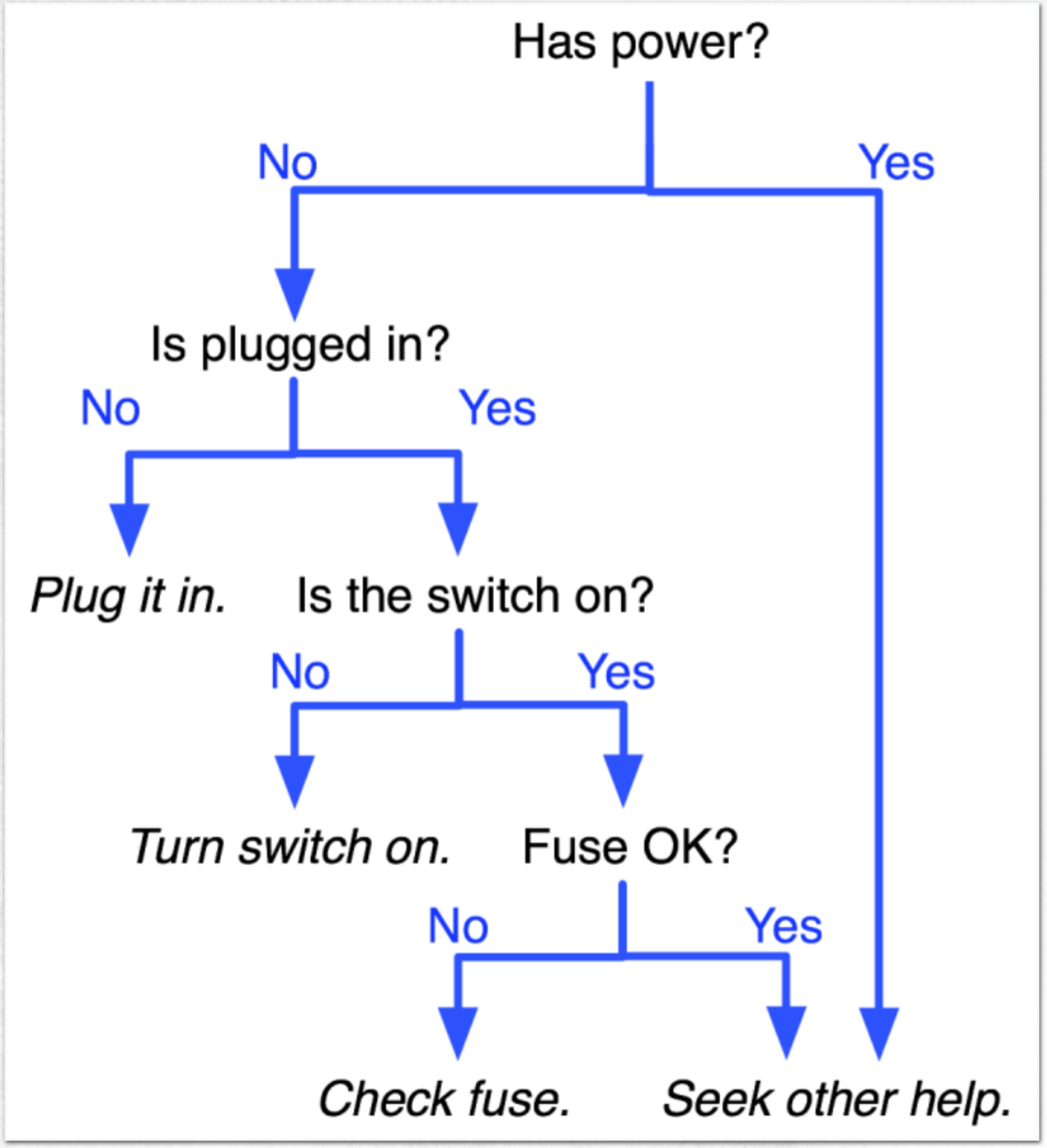


| $e_1$ | $e_2$ | $e_1$ && $e_2$ | $e_1$ \|\| $e_2$ | !$e_1$ |
|---|---|---|---|---|
| false | false | false | false | true |
| false | true | false | true | true |
| true | false | false | true | false |
| true | true | true | true | false |

**Listing 5.7: newcheckrange.cpp**

```cpp
#include <iostream>

int main() {
    int value;
    std::cout << "Please enter an integer value in the range 0...10: ";
    std::cin >> value;
    if (value >= 0 && value <= 10)
        std::cout << "In range\n";
}
```

## Nested *if-else* Statement



```
if ( condition )
{
   do something ...

   if ( condition )
   {
      do something ...

   }
   else if ( condition )
   {
      do something ...

   }
   else
   {
      do something ...
   }
}
```

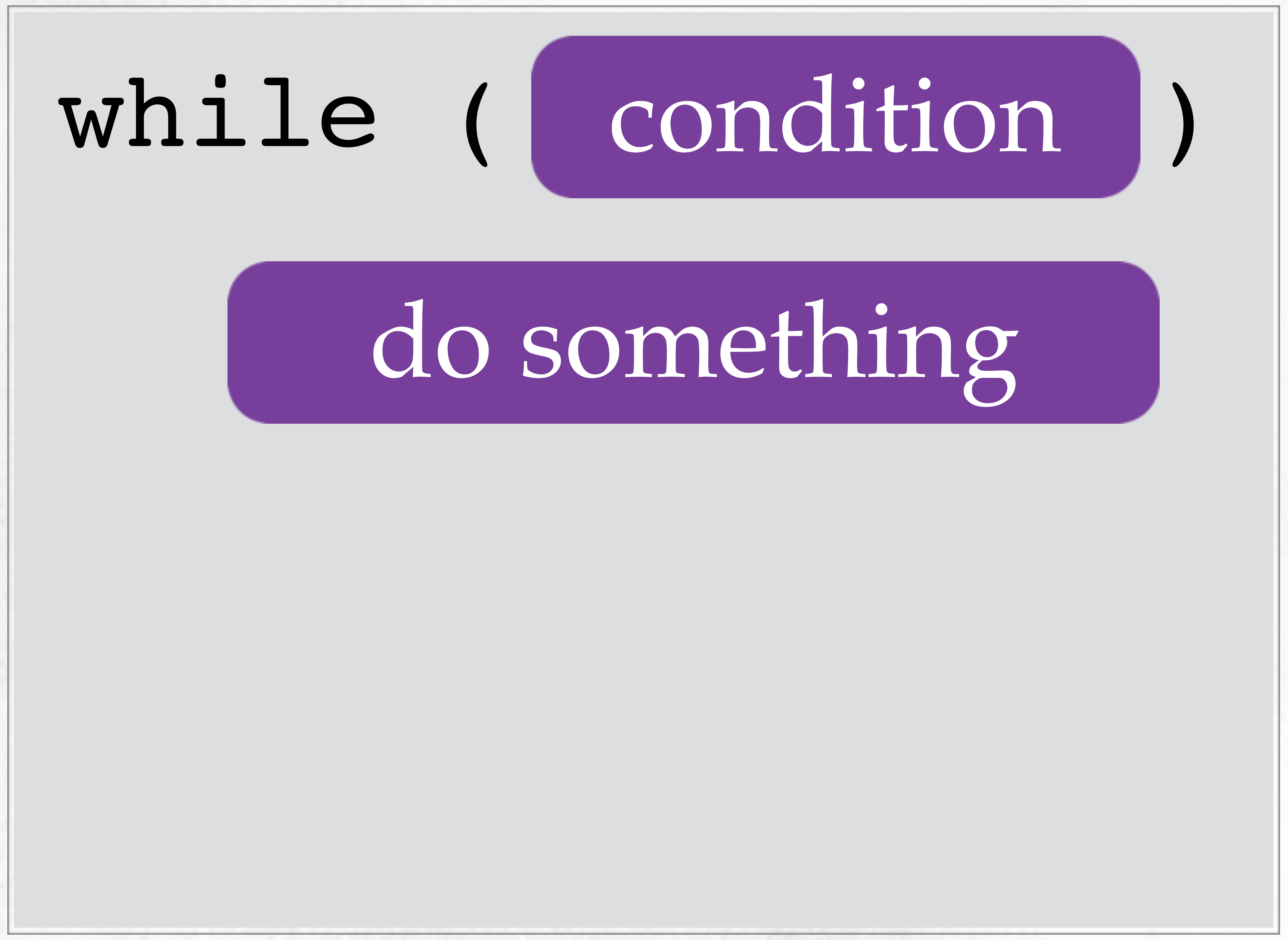
## Nested *if-else* Statement Example

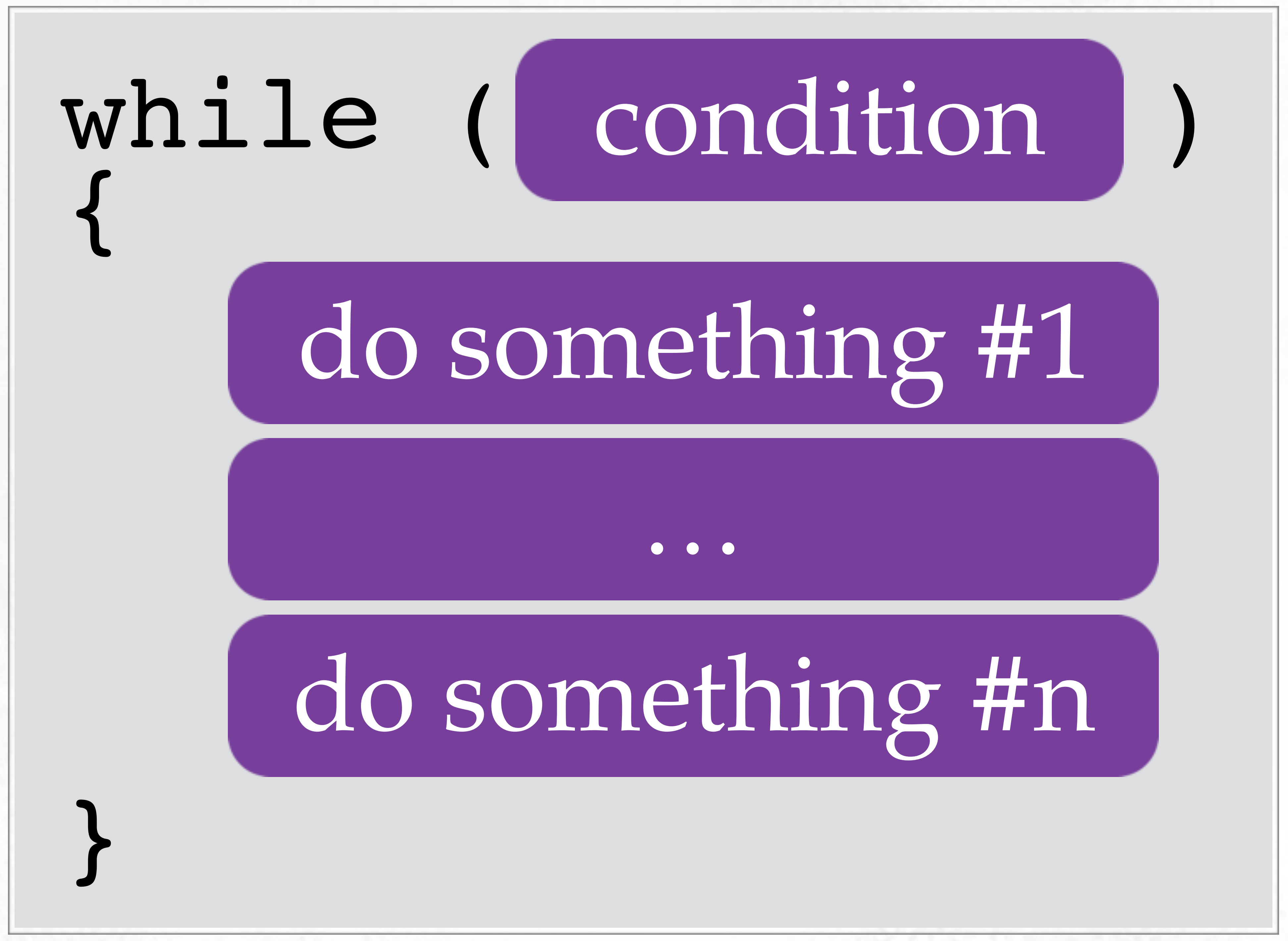
- Code Review: Listing 5.13 & 5.16 in Textbook

**Let’s read together !!**

## Statement Description

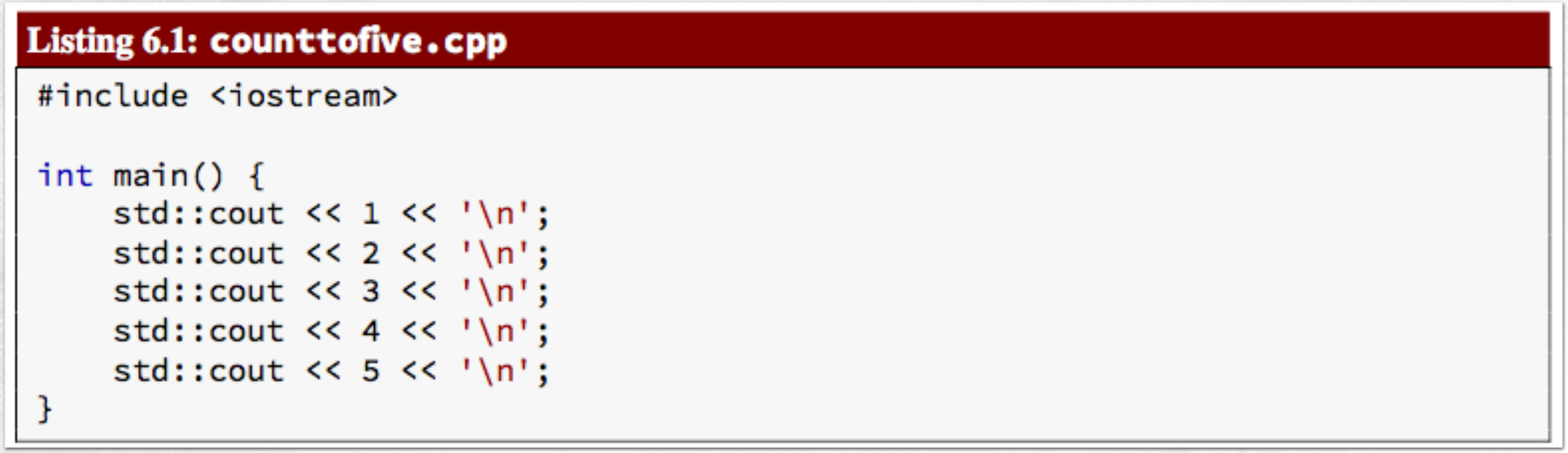
- *" Don't speak! while you work! "*
- Iteration
  - Single statement Iteration
  - Multiple statement Iteration





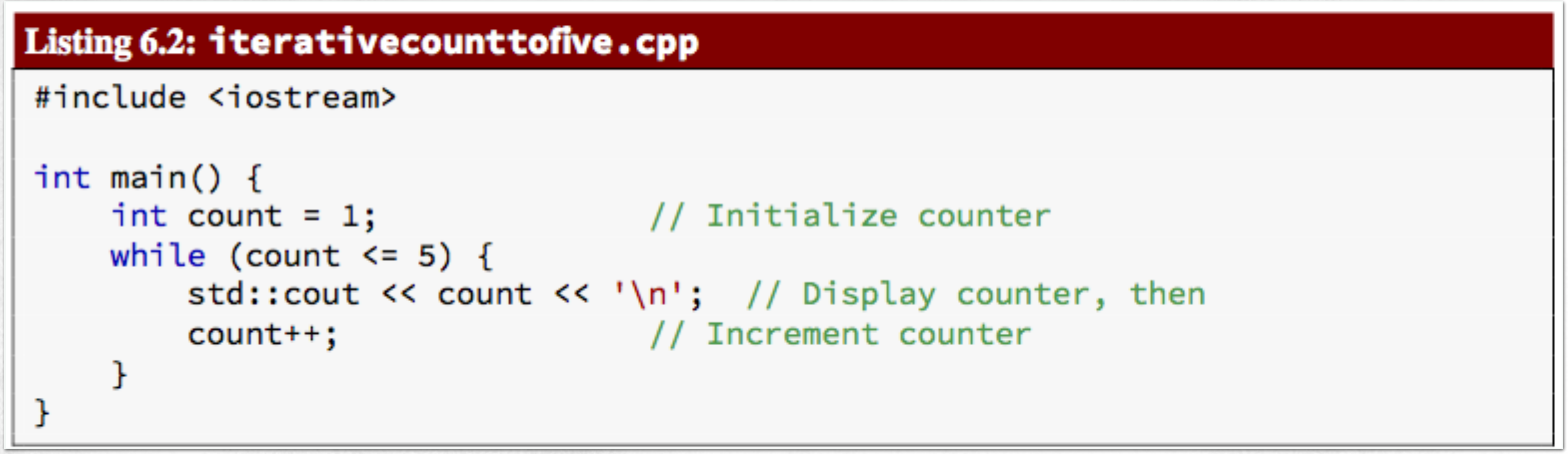
while statement

## Statement Example



**Listing 6.1: counttofive.cpp**

```cpp
#include <iostream>

int main() {
    std::cout << 1 << '\n';
    std::cout << 2 << '\n';
    std::cout << 3 << '\n';
    std::cout << 4 << '\n';
    std::cout << 5 << '\n';
}
```

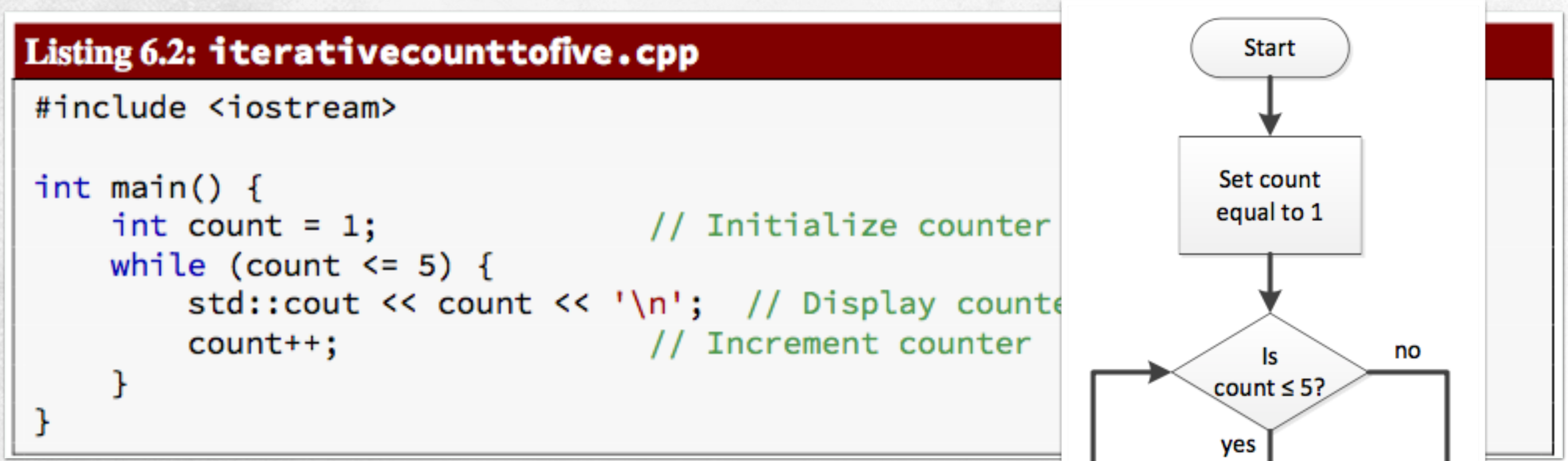


**Listing 6.2: iterativecounttofive.cpp**

```cpp
#include <iostream>

int main() {
    int count = 1;                  // Initialize counter
    while (count <= 5) {
        std::cout << count << '\n';  // Display counter, then
        count++;                    // Increment counter
    }
}
```

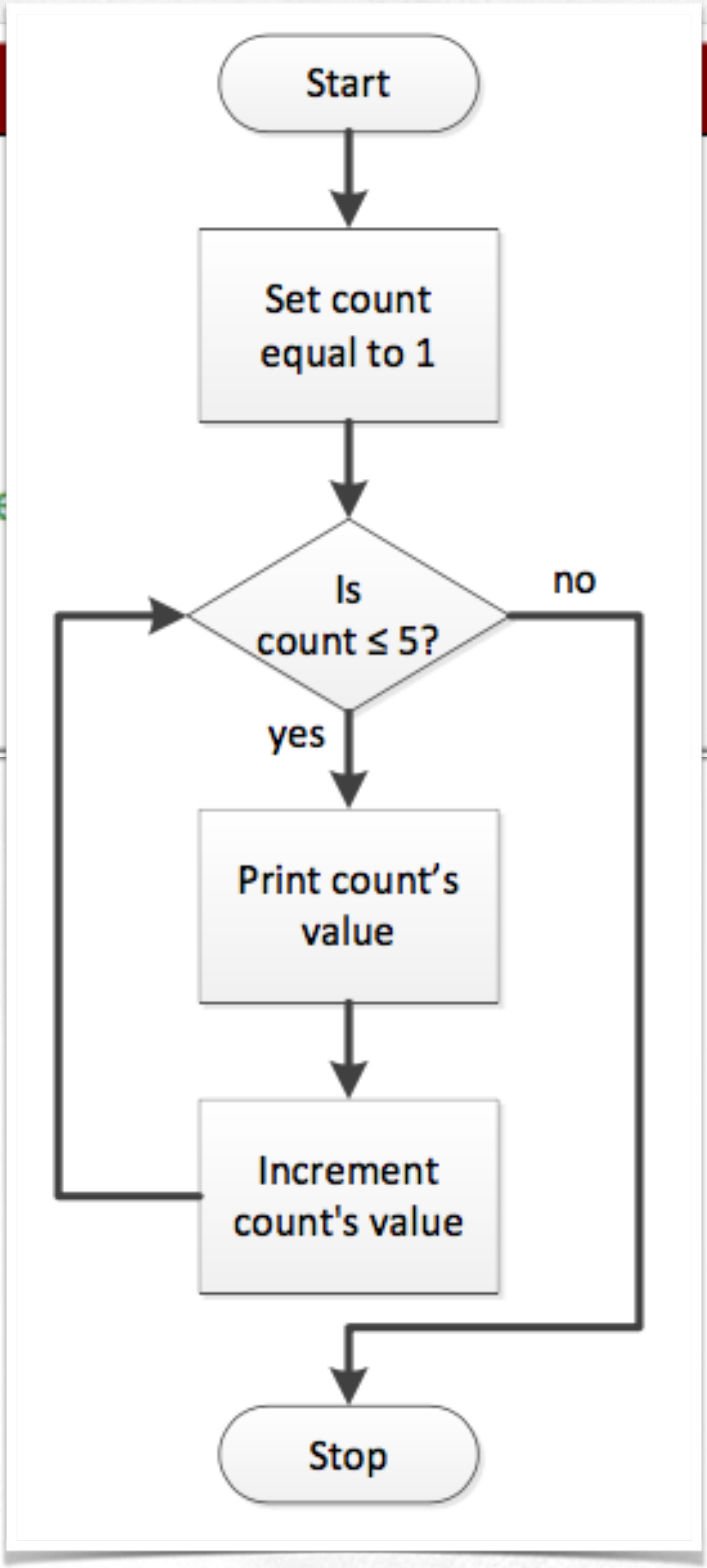
while statement

## Statement Example



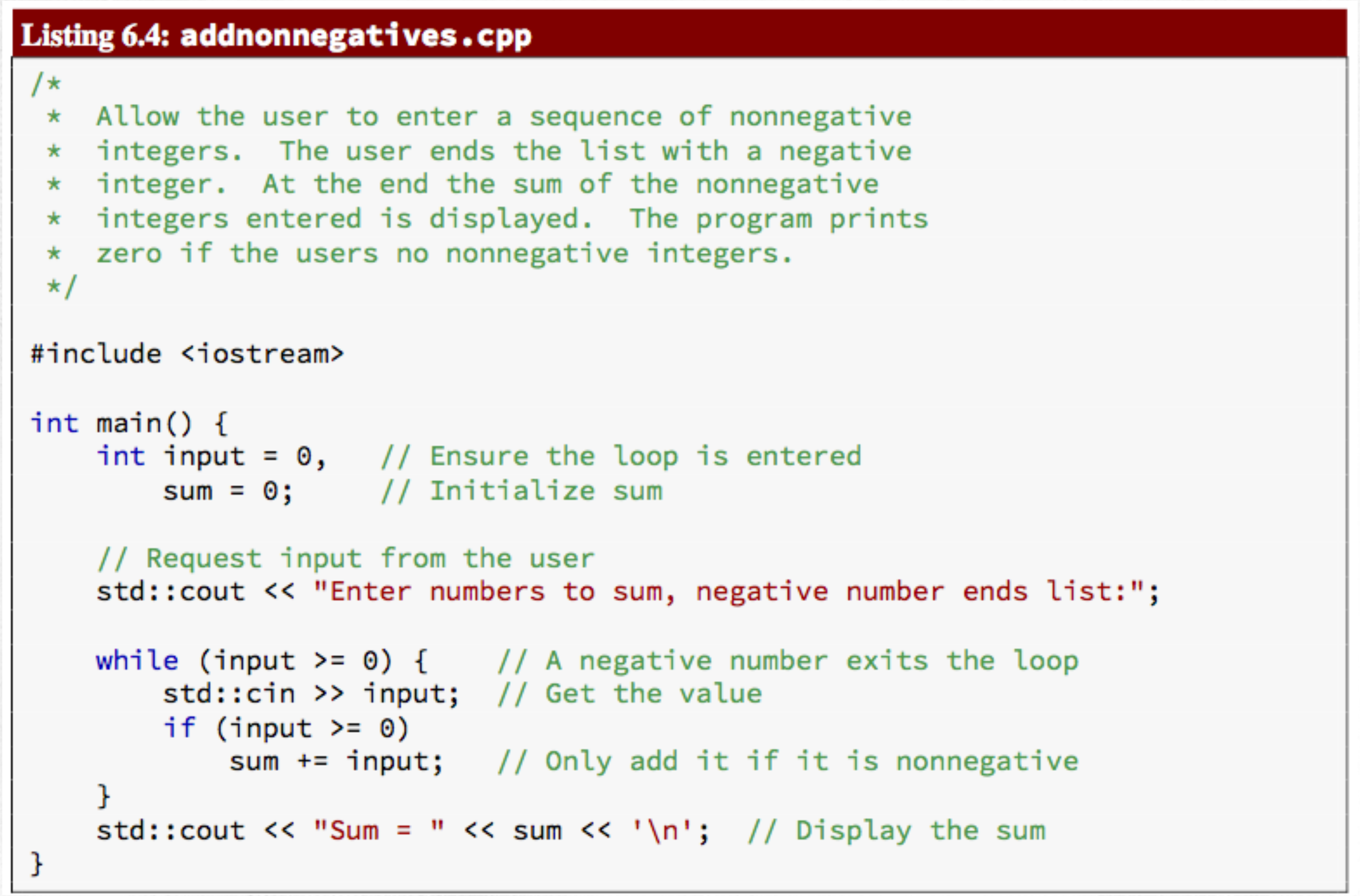
**Listing 6.2: iterativecounttofive.cpp**

```cpp
#include <iostream>

int main() {
    int count = 1;              // Initialize counter
    while (count <= 5) {
        std::cout << count << '\n';   // Display counte
        count++;                // Increment counter
    }
}
```



while statement

## Mixed with Conditional Statement



**Listing 6.4: addnonnegatives.cpp**

```
/*
 *  Allow the user to enter a sequence of nonnegative
 *  integers.  The user ends the list with a negative
 *  integer.  At the end the sum of the nonnegative
 *  integers entered is displayed.  The program prints
 *  zero if the users no nonnegative integers.
 */

#include <iostream>

int main() {
    int input = 0,    // Ensure the loop is entered
        sum = 0;      // Initialize sum

    // Request input from the user
    std::cout << "Enter numbers to sum, negative number ends list:";

    while (input >= 0) {     // A negative number exits the loop
        std::cin >> input;   // Get the value
        if (input >= 0)
            sum += input;    // Only add it if it is nonnegative
    }
    std::cout << "Sum = " << sum << '\n';  // Display the sum
}
```

while statement

## Example with standard functions (1/3)

**Listing 6.6: powersof10.cpp**

```cpp
#include <iostream>

int main() {
    int power = 1;
    while (power <= 1000000000) {
        std::cout << power << '\n';
        power *= 10;
    }
}
```

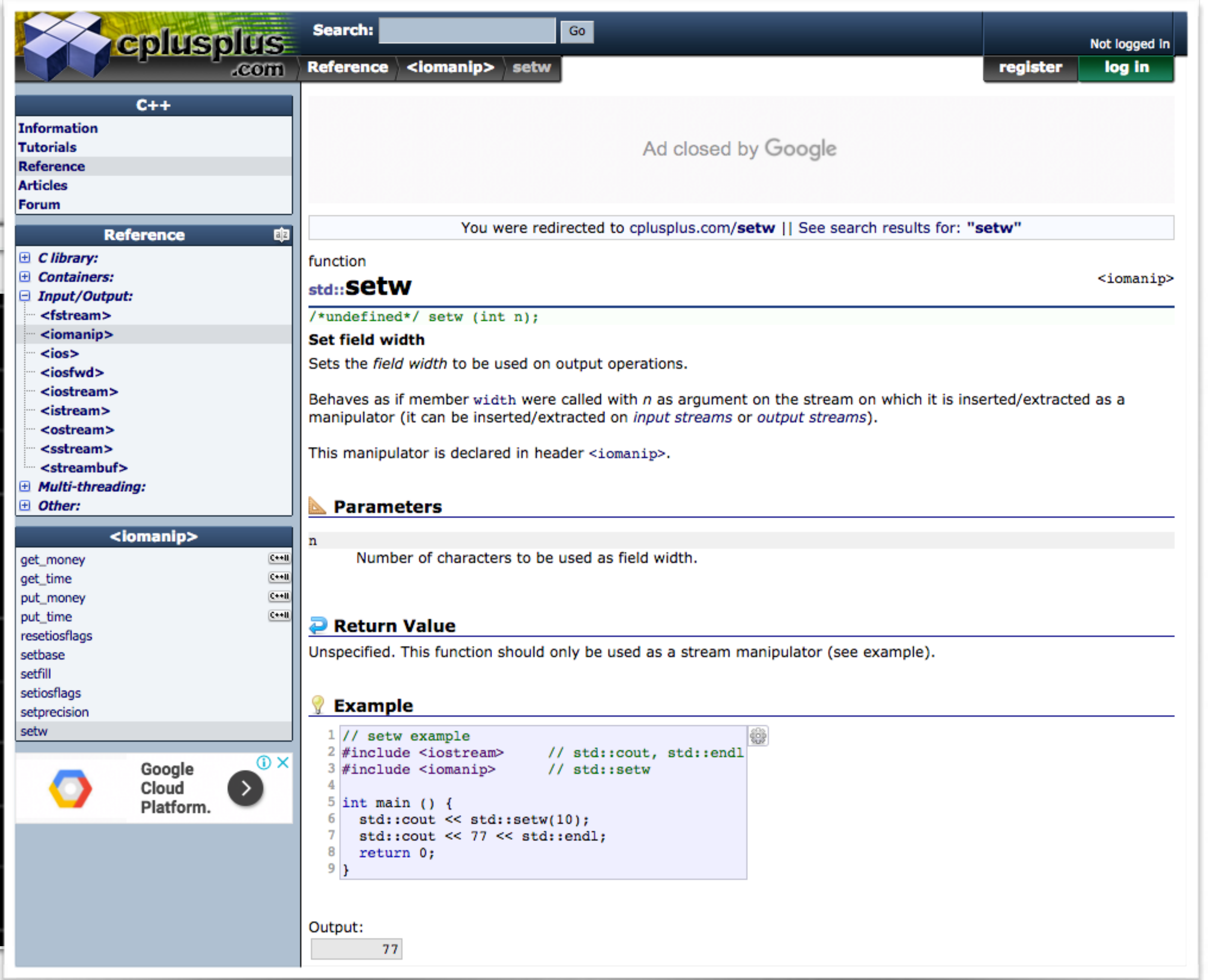
```
1
10
100
1000
10000
100000
1000000
10000000
100000000
1000000000
```

## Example with standard functions (2/3)

**Listing 6.7: powersof10justified.cpp**

```cpp
#include <iostream>
#include <iomanip>

// Print the powers of 10 from 1 to 1,000,000,000
int main() {
    int power = 1;
    while (power <= 1000000000) {
        // Right justify each number in a field 10 wide
        std::cout << std::setw(10) << power << '\n';
        power *= 10;
    }
}
```

```
         1
        10
       100
      1000
     10000
    100000
   1000000
  10000000
 100000000
1000000000
```



You were redirected to cplusplus.com/**setw** || See search results for: **"setw"**

function
**std::setw** <iomanip>

`/*undefined*/ setw (int n);`

**Set field width**

Sets the *field width* to be used on output operations.

Behaves as if member `width` were called with *n* as argument on the stream on which it is inserted/extracted as a manipulator (it can be inserted/extracted on *input streams* or *output streams*).

This manipulator is declared in header `<iomanip>`.

**Parameters**

n
Number of characters to be used as field width.

**Return Value**

Unspecified. This function should only be used as a stream manipulator (see example).

**Example**

```cpp
// setw example
#include <iostream>     // std::cout, std::endl
#include <iomanip>      // std::setw

int main () {
  std::cout << std::setw(10);
  std::cout << 77 << std::endl;
  return 0;
}
```

Output:

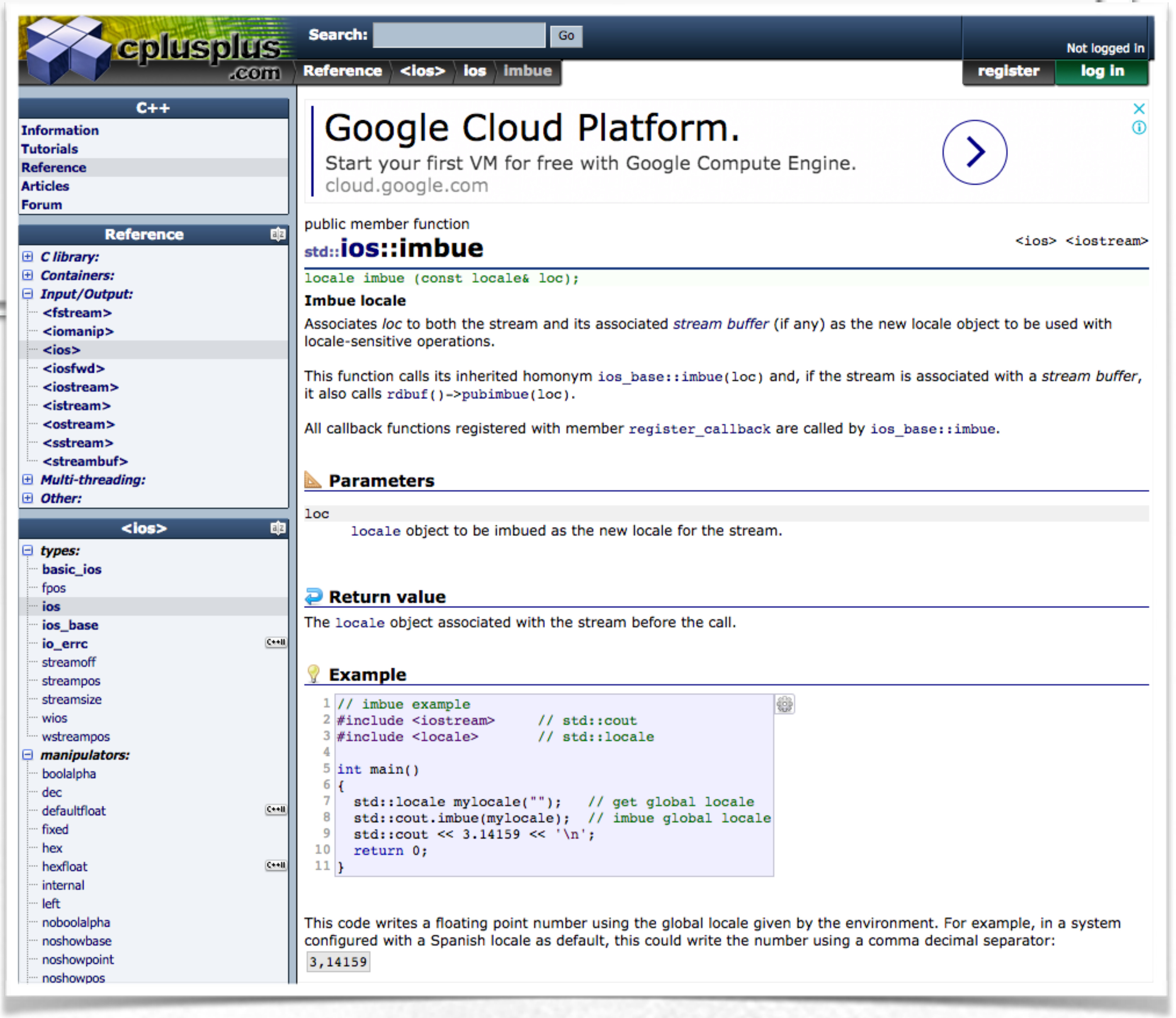
```
        77
```

## Example with standard functions (3/3)

**Listing 6.8: `powersof10withcommas.cpp`**

```cpp
#include <iostream>
#include <iomanip>
#include <locale>

// Print the powers of 10 from 1 to 1,000,000,000
int main() {
    int power = 1;
    std::cout.imbue(std::locale(""));
    while (power <= 1000000000) {
        // Right justify each number in a field 10 wide
        std::cout << std::setw(13) << power << '\n';
        power *= 10;
    }
}
```

```
            1
           10
          100
        1,000
       10,000
      100,000
    1,000,000
   10,000,000
  100,000,000
1,000,000,000
```



public member function

**std::ios::imbue** `<ios> <iostream>`

`locale imbue (const locale& loc);`

**Imbue locale**

Associates *loc* to both the stream and its associated *stream buffer* (if any) as the new locale object to be used with locale-sensitive operations.

This function calls its inherited homonym `ios_base::imbue(loc)` and, if the stream is associated with a *stream buffer*, it also calls `rdbuf()->pubimbue(loc)`.

All callback functions registered with member `register_callback` are called by `ios_base::imbue`.

**Parameters**

loc
: `locale` object to be imbued as the new locale for the stream.

**Return value**

The `locale` object associated with the stream before the call.

**Example**

```cpp
// imbue example
#include <iostream>     // std::cout
#include <locale>       // std::locale

int main()
{
  std::locale mylocale("");   // get global locale
  std::cout.imbue(mylocale);  // imbue global locale
  std::cout << 3.14159 << '\n';
  return 0;
}
```

This code writes a floating point number using the global locale given by the environment. For example, in a system configured with a Spanish locale as default, this could write the number using a comma decimal separator:

```
3,14159
```

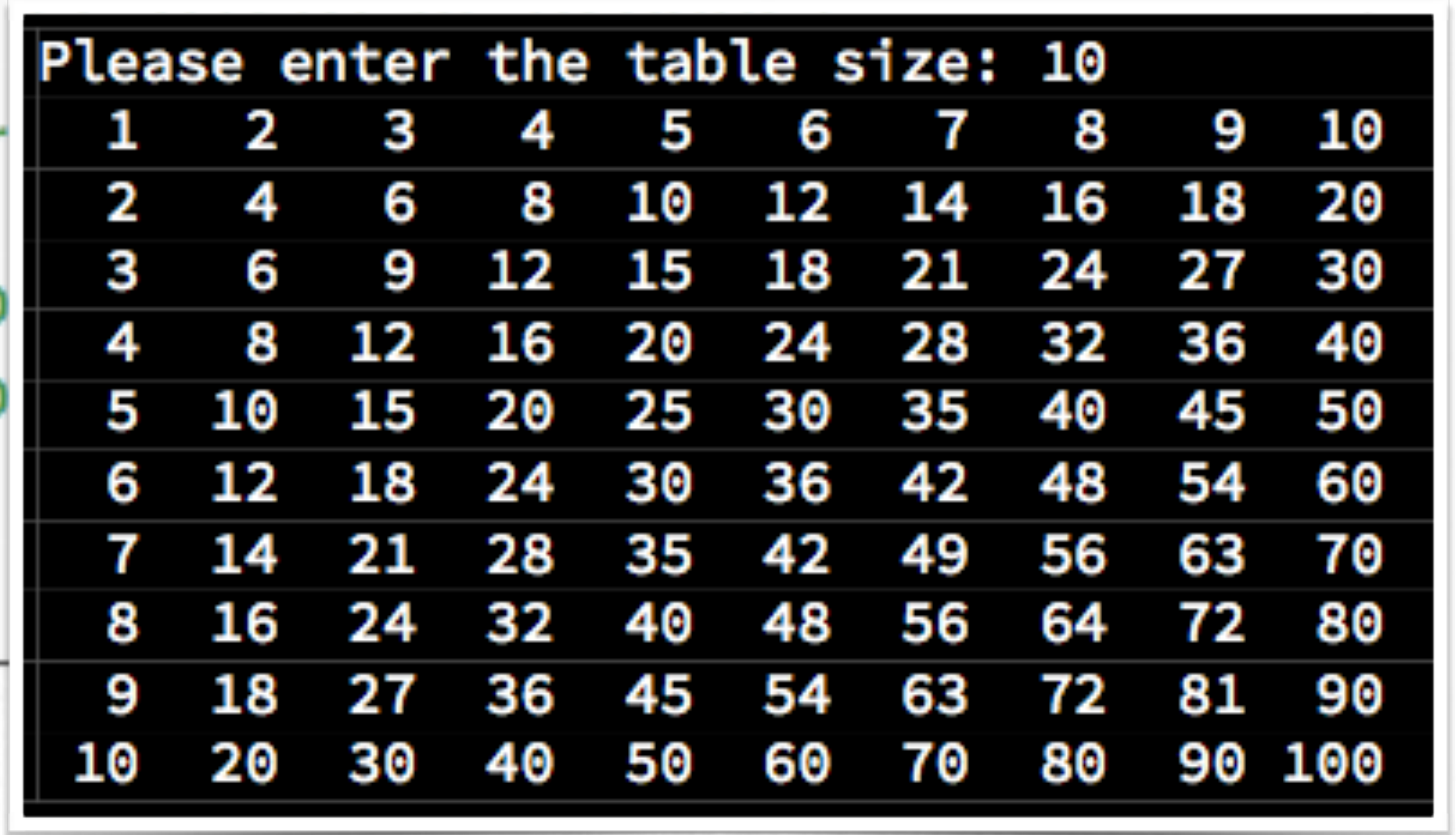
## Nested *while* Statement

```
while ( condition )
{
    do something …

    while ( condition )
    {

        do something …

    }

    do something …
}
```

## Nested *while* Statement Example

**Listing 6.12: timestable-3rd-try.cpp**

```
#include <iostream>
#include <iomanip>

int main() {
    int size;  // The number of rows and columns in the table
    std::cout << "Please enter the table size: ";
    std::cin >> size;
    // Print a size x size multiplication table
    int row = 1;
    while (row <= size) {                 // Table has size rows.
        int column = 1;                    // Reset column for each row.
        while (column <= size) {          // Table has size columns.
            int product = row*column;      // Compute product
            std::cout << std::setw(4) << product; // Display product
            column++;                      // Next el
        }
        std::cout << '\n';                      // Mo
        row++;                             // Next ro
    }
}
```



```
Please enter the table size: 10
   1   2   3   4   5   6   7   8   9  10
   2   4   6   8  10  12  14  16  18  20
   3   6   9  12  15  18  21  24  27  30
   4   8  12  16  20  24  28  32  36  40
   5  10  15  20  25  30  35  40  45  50
   6  12  18  24  30  36  42  48  54  60
   7  14  21  28  35  42  49  56  63  70
   8  16  24  32  40  48  56  64  72  80
   9  18  27  36  45  54  63  72  81  90
  10  20  30  40  50  60  70  80  90 100
```

# Object Oriented Programming by C++

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