Object Oriented Programming by C++

Selection & Repetition (2/2)

Conditional execution and Iteration (Loop)

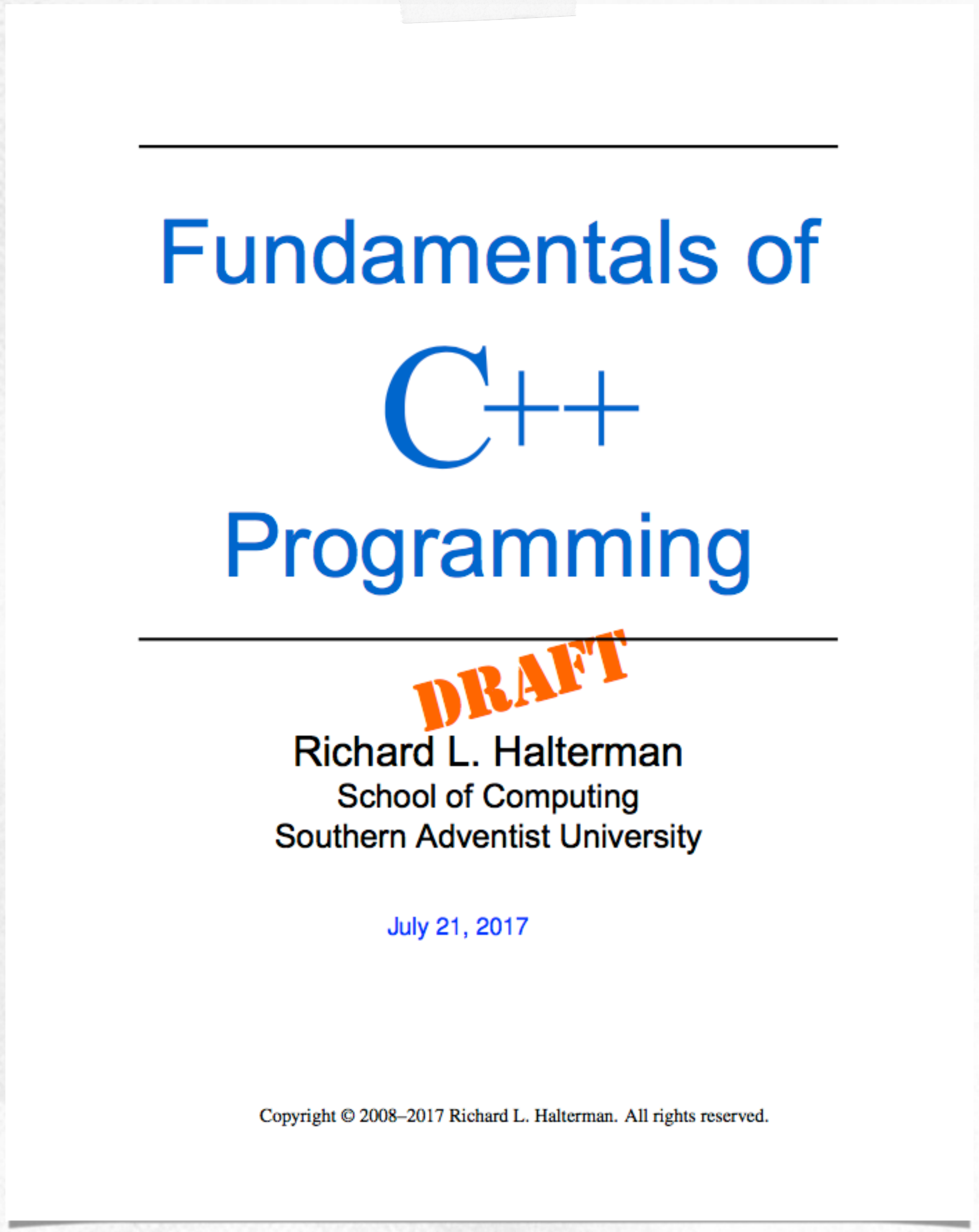
2017. 8.

Sungwon Lee / Professor

Email: drsungwon@khu.ac.kr
Web: http://mobilelab.khu.ac.kr/

Textbook & Copyright

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



Fundamentals of C++ Programming

DRAFT

Richard L. Halterman
School of Computing
Southern Adventist University

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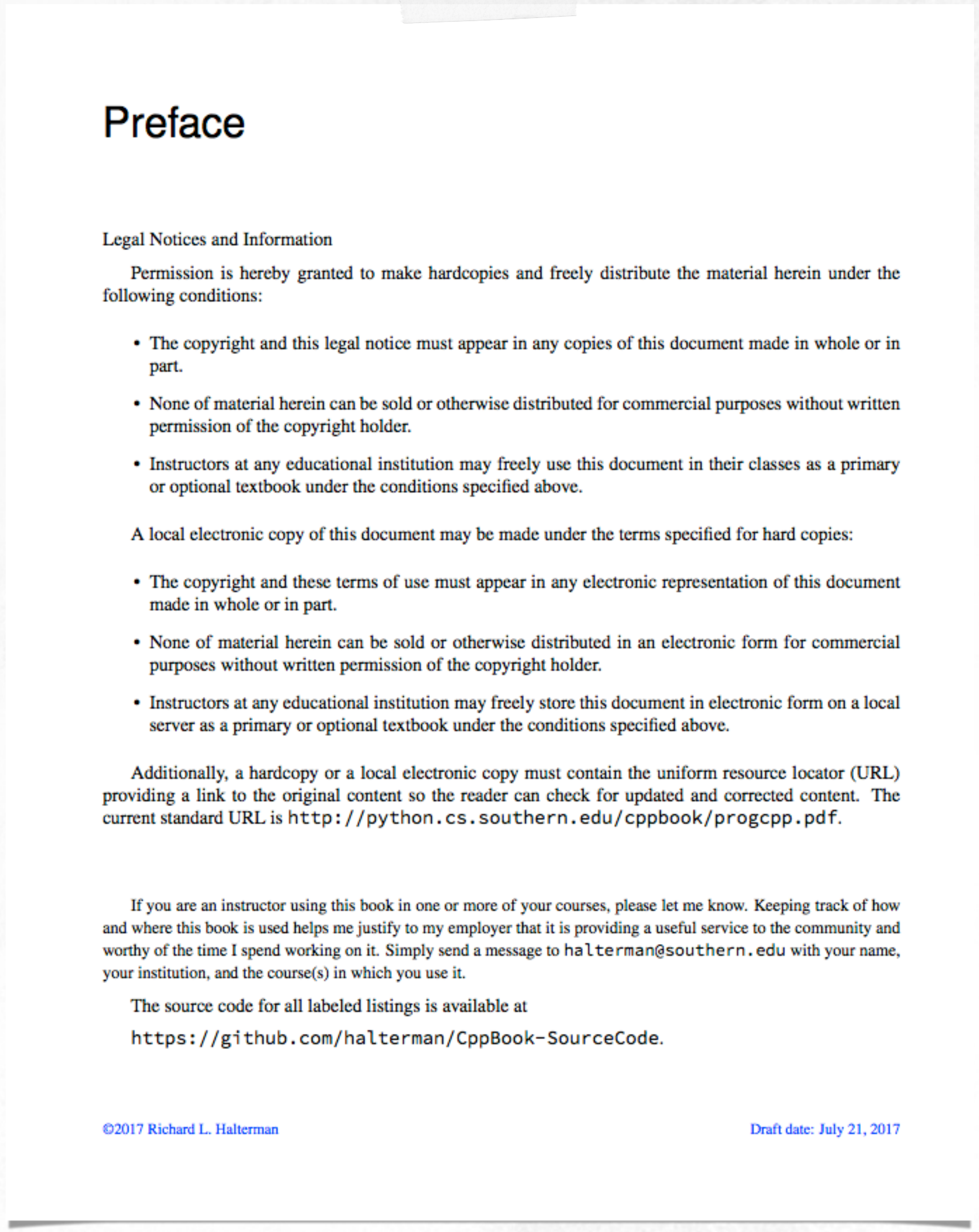

Preface

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The source code for all labeled listings is available at

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

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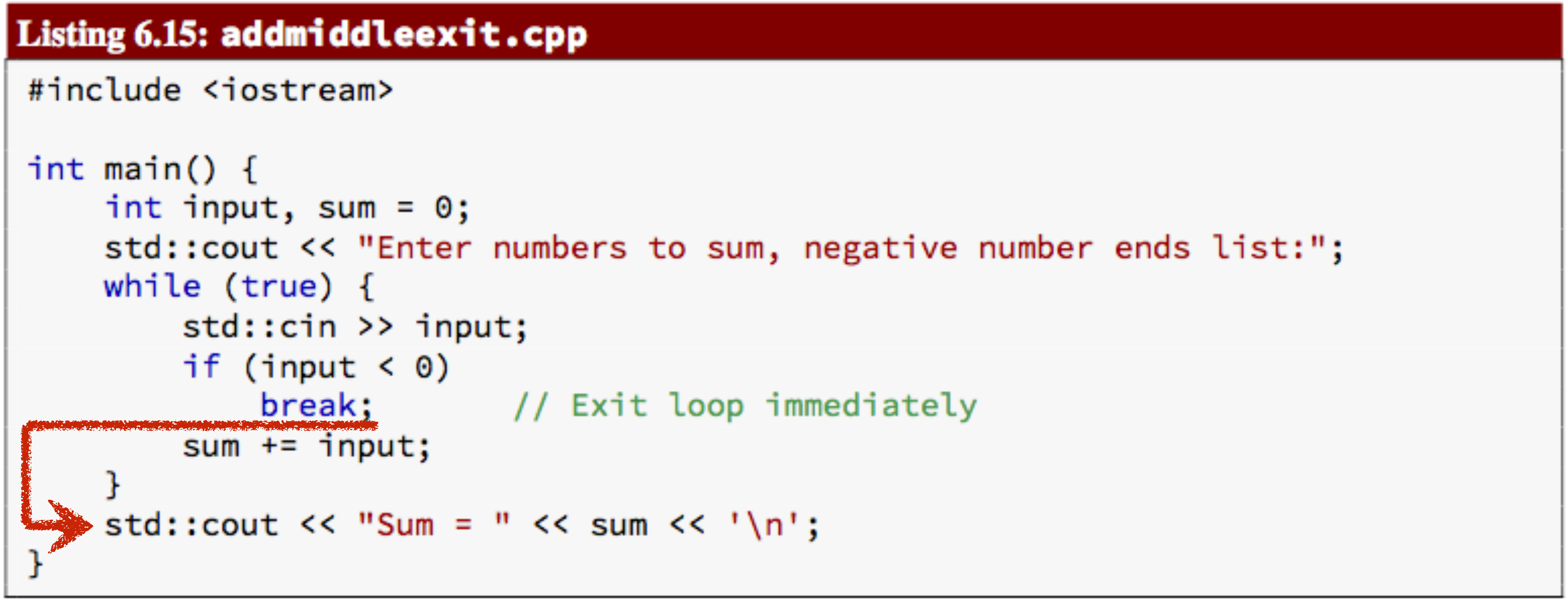
Contents

Abnormal Loop Termination

break statement

- *break*: causes the immediate exit from the body of the loop



Listing 6.15: addmiddleexit.cpp

```cpp
#include <iostream>

int main() {
    int input, sum = 0;
    std::cout << "Enter numbers to sum, negative number ends list:";
    while (true) {
        std::cin >> input;
        if (input < 0)
            break;        // Exit loop immediately
        sum += input;
    }
    std::cout << "Sum = " << sum << '\n';
}
```

if (input < 0) is true;
  Step.1: get out of while{…} statement,
  Step.2: go to next the line after while(){…} statement

Abnormal Loop Termination

continue statement

- *continue*: causes the immediate jump to the start of the loop

Listing 6.15: addmiddleexit.cpp

```
#include <iostream>

int main() {
    int input, sum = 0;
    std::cout << "Enter numbers to sum, negative number ends list:";
    while (true) {
        std::cin >> input;
        if (input < 0)
            continue:          // Exit loop immediately
        sum += input;
    }
    std::cout << "Sum = " << sum << '\n';
}
```

if (input < 0) is true;
  Step.1: get out of while{…} statement,
  Step.2: go to the *condition* of while(){…} statement

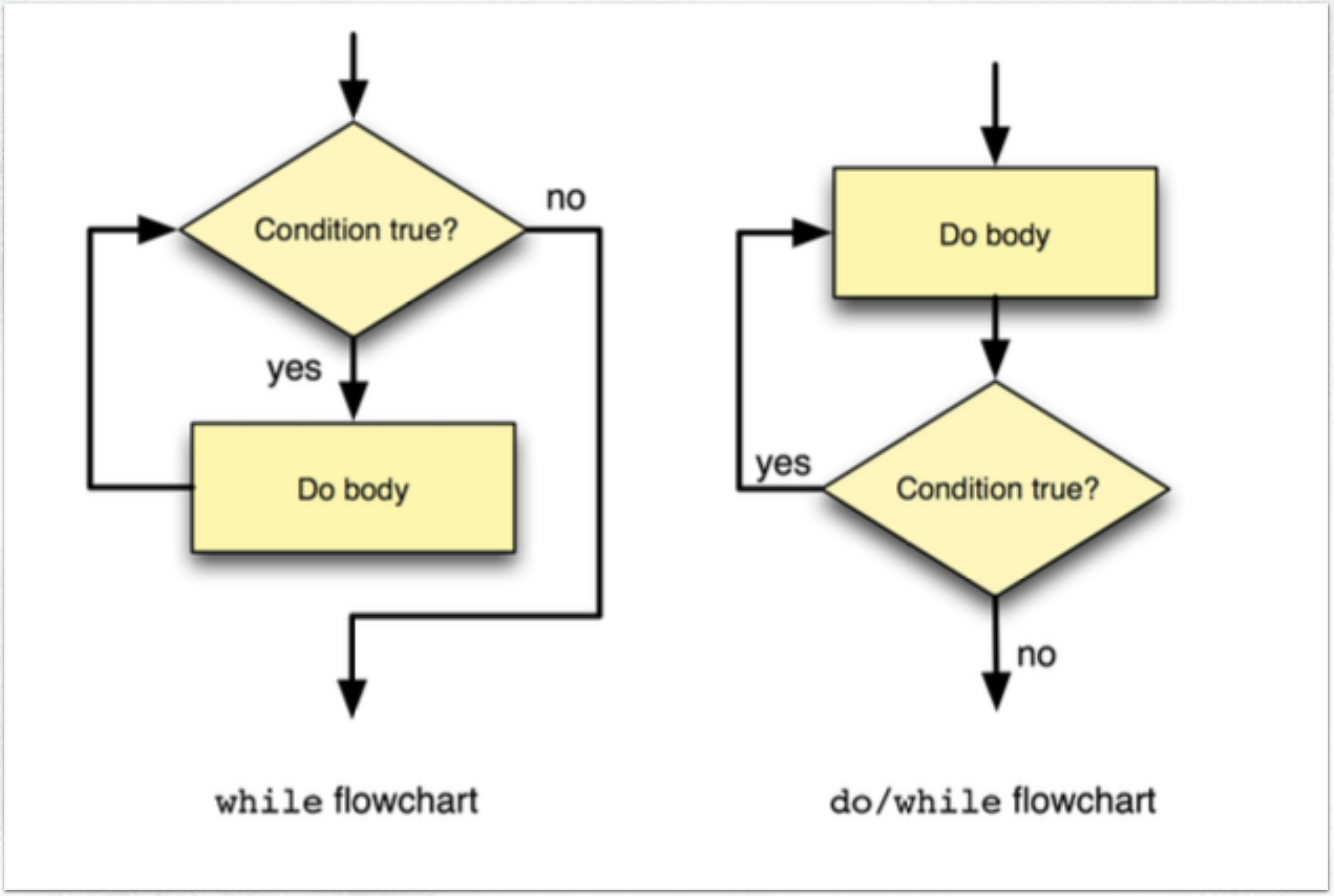
Abnormal Loop Termination

goto statement

Don’t use !!

while vs. do-while

- "Just do it! "



Example using *while* Statement

Listing 7.2: goodinputonly.cpp

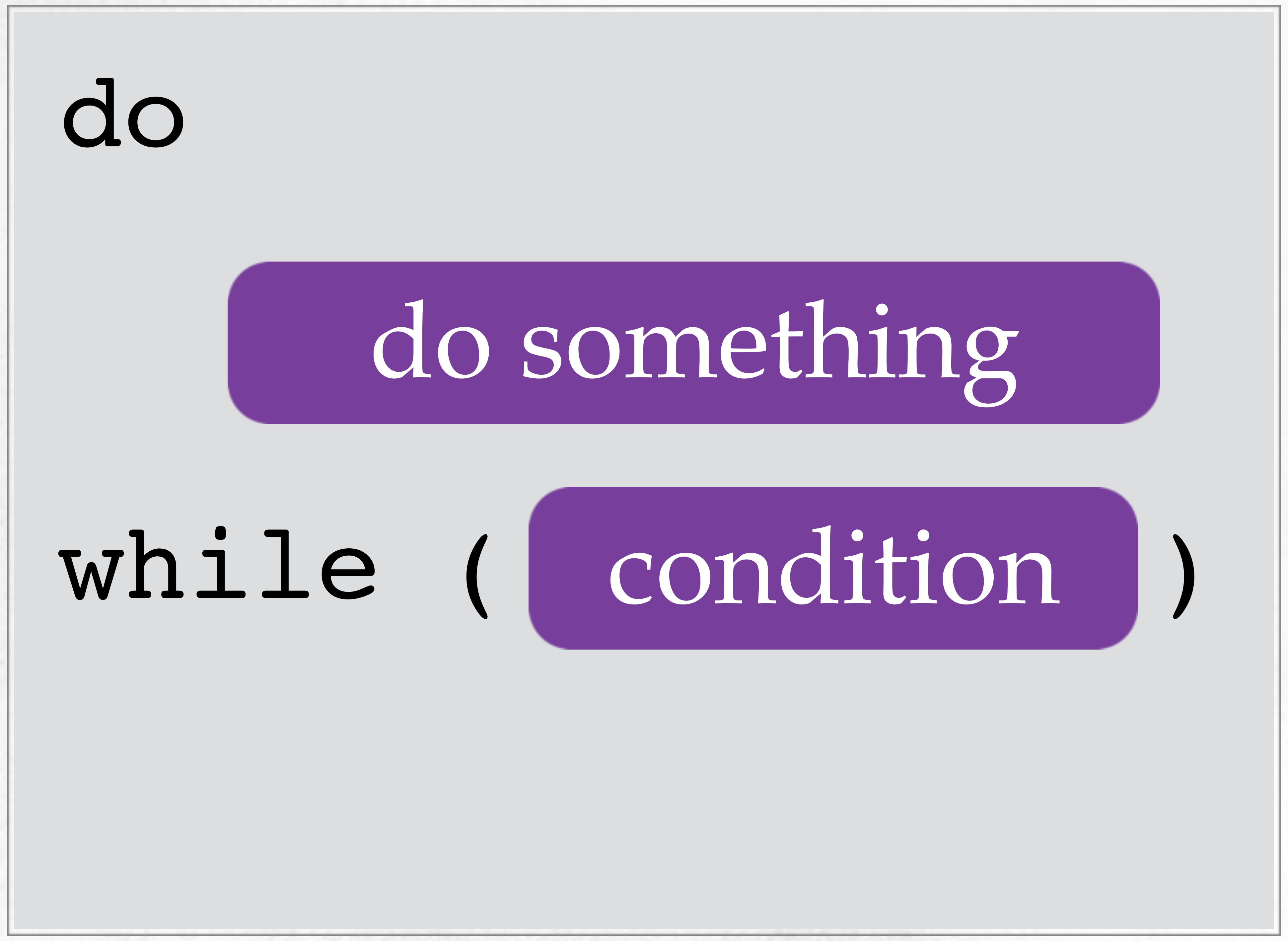
```cpp
#include <iostream>

int main() {
    int in_value = -1;
    std::cout << "Please enter an integer in the range 0-10: ";
    // Insist on values in the range 0...10
    while (in_value < 0 || in_value > 10)
        std::cin >> in_value;
    // in_value at this point is guaranteed to be within range
    std::cout << "Legal value entered was " << in_value << '\n';
}
```

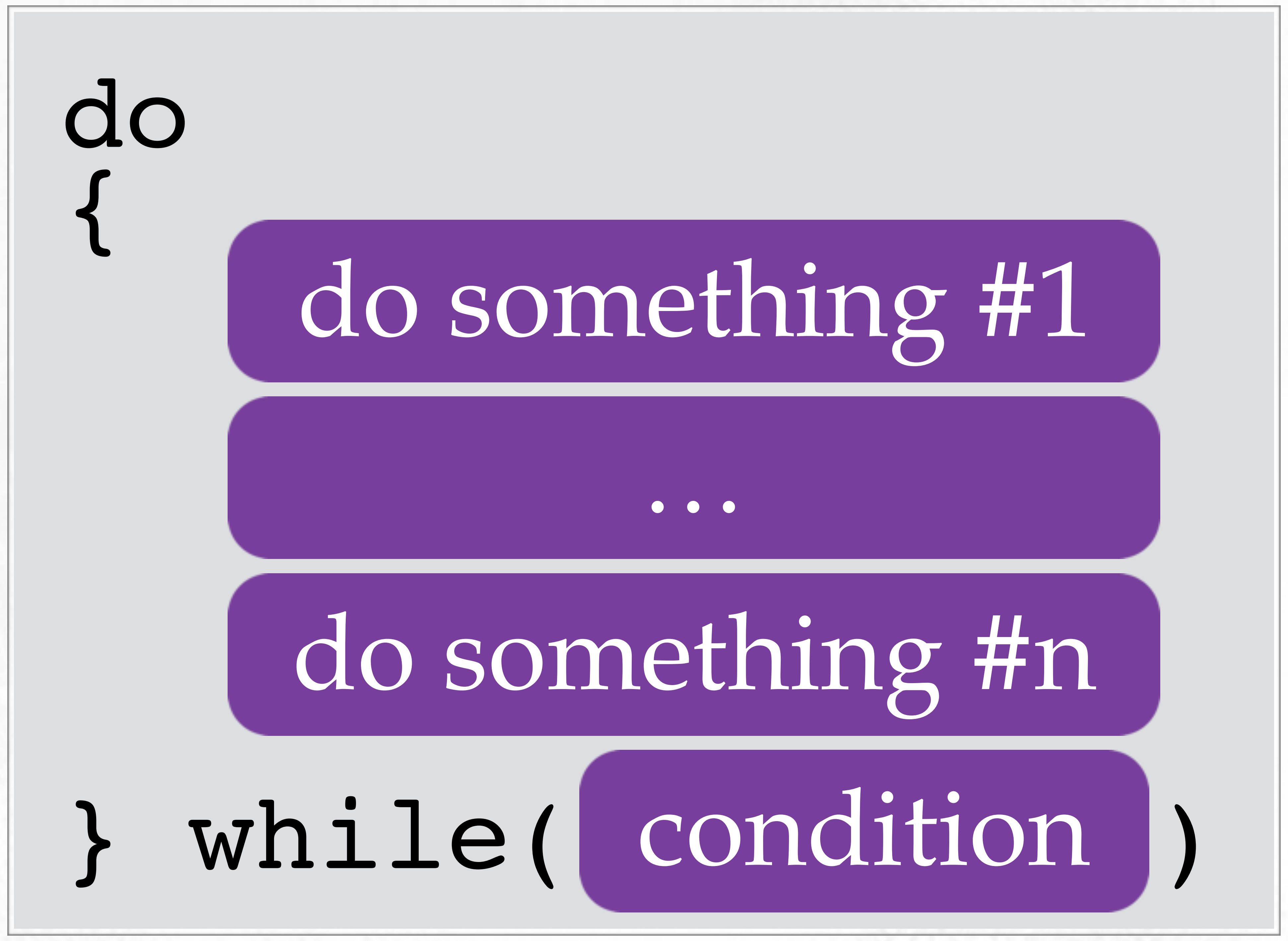
do-while Statement

Example using *while* Statement

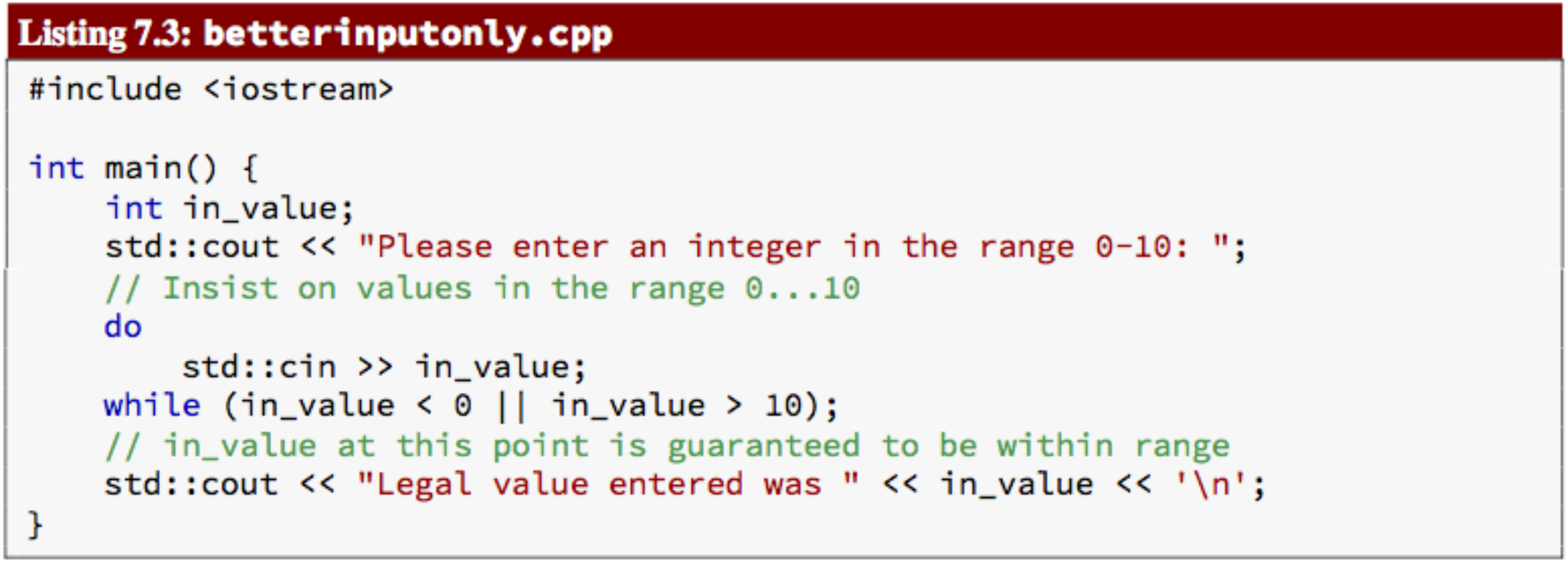
- *" Just do it! "*

- Iteration
  - Single statement Iteration
  - Multiple statement Iteration


```
do

      do something

while ( condition )
```


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

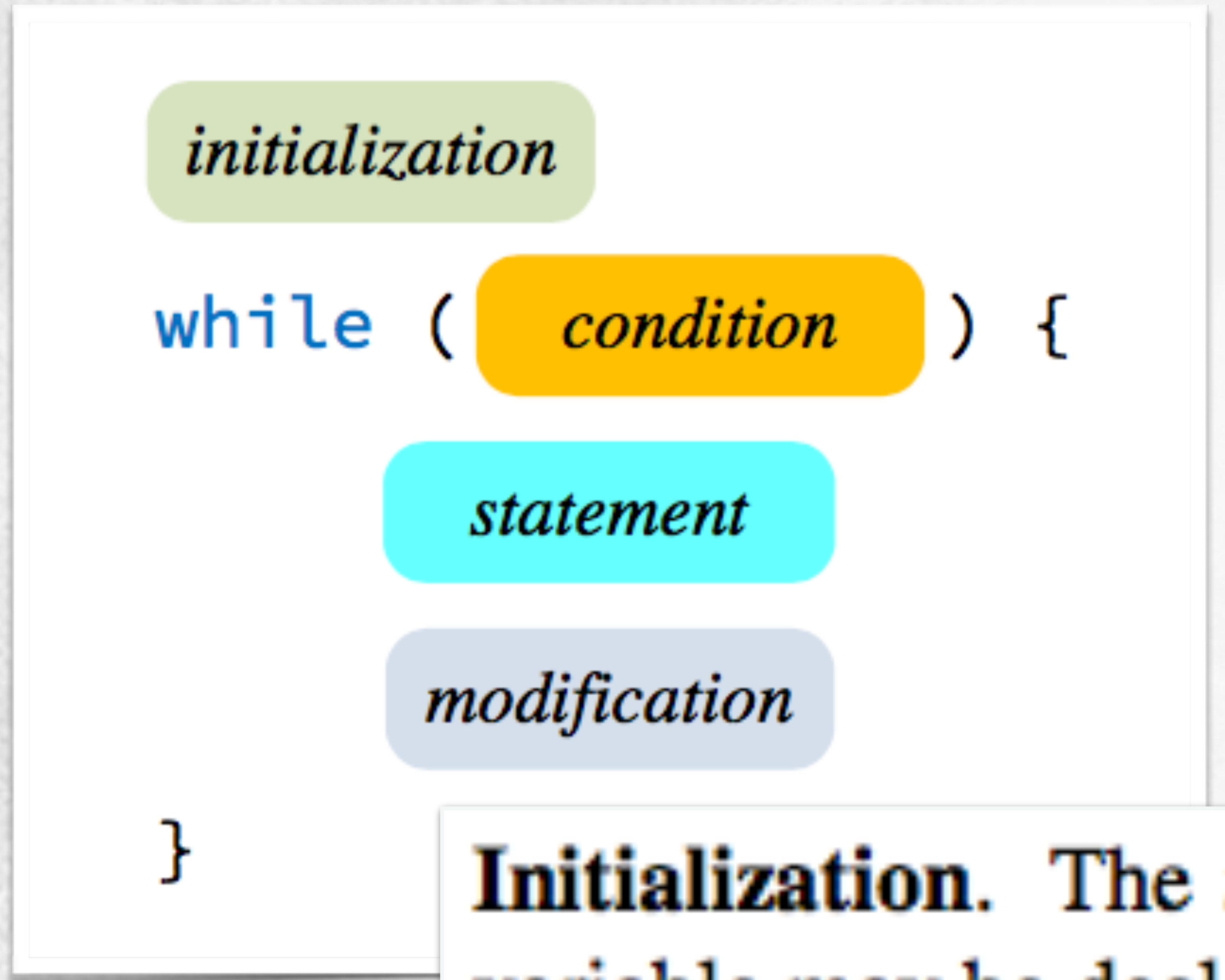
Example using *do-while* Statement



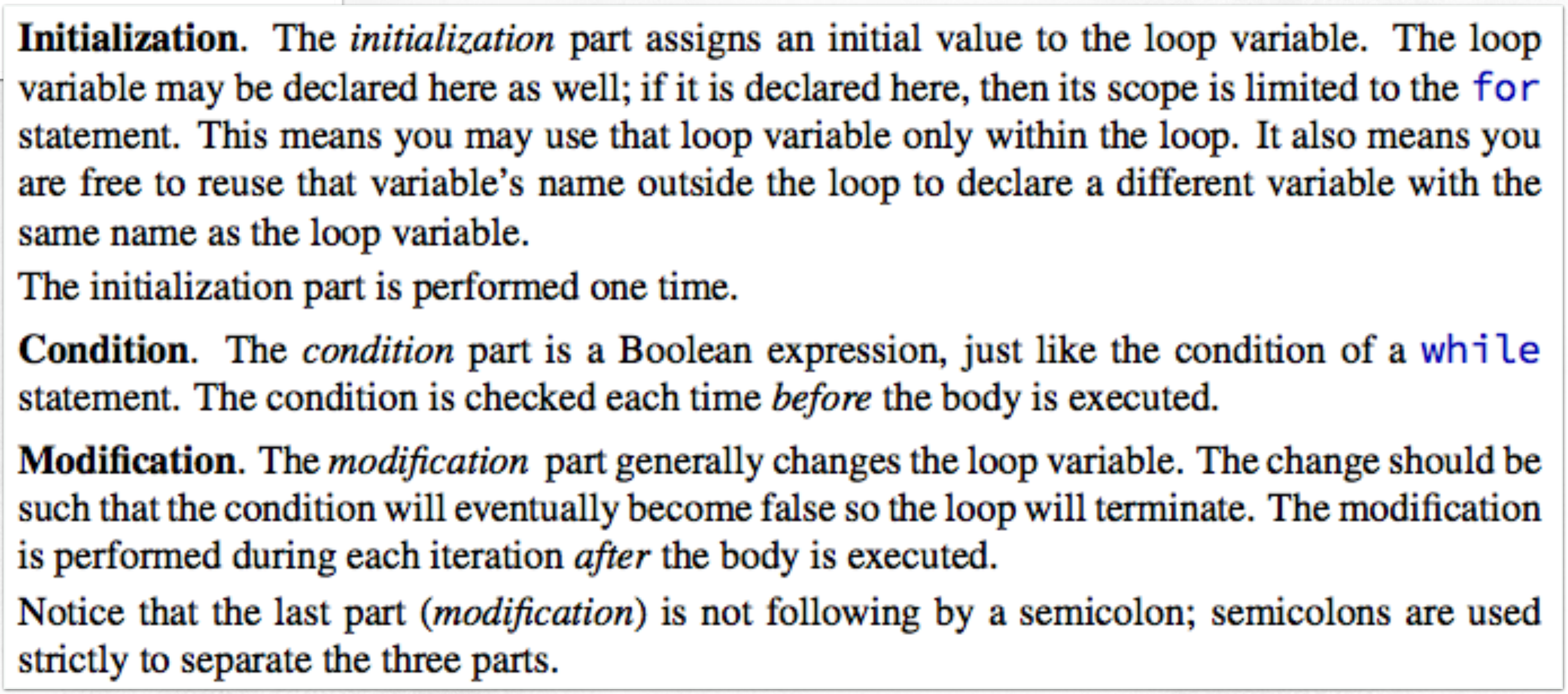
Listing 7.3: betterinputonly.cpp

```
#include <iostream>

int main() {
    int in_value;
    std::cout << "Please enter an integer in the range 0-10: ";
    // Insist on values in the range 0...10
    do
        std::cin >> in_value;
    while (in_value < 0 || in_value > 10);
    // in_value at this point is guaranteed to be within range
    std::cout << "Legal value entered was " << in_value << '\n';
}
```

Component of Loop Statement



```
initialization

while ( condition ) {

        statement

        modification

}
```



Initialization. The *initialization* part assigns an initial value to the loop variable. The loop variable may be declared here as well; if it is declared here, then its scope is limited to the `for` statement. This means you may use that loop variable only within the loop. It also means you are free to reuse that variable's name outside the loop to declare a different variable with the same name as the loop variable.

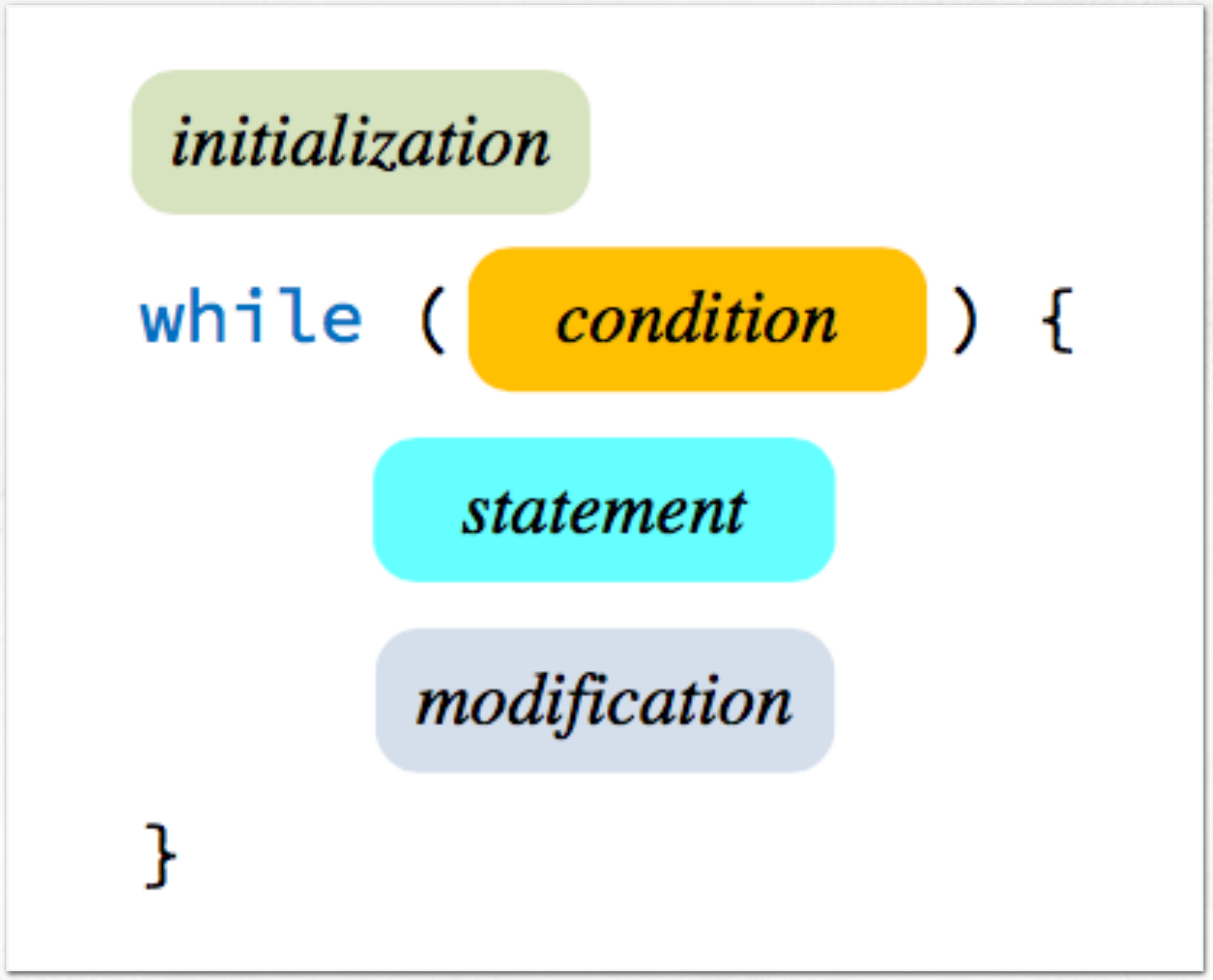
The initialization part is performed one time.

Condition. The *condition* part is a Boolean expression, just like the condition of a `while` statement. The condition is checked each time *before* the body is executed.

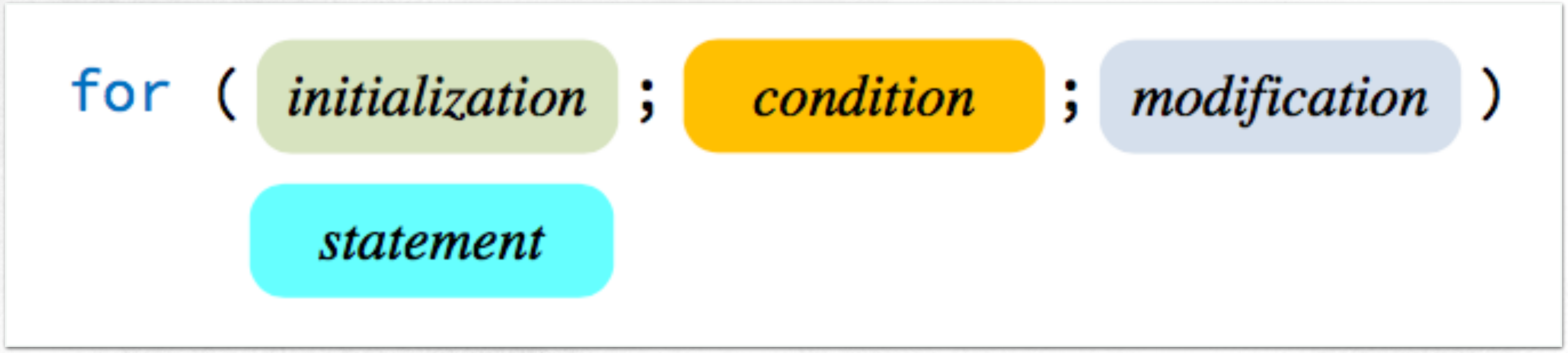
Modification. The *modification* part generally changes the loop variable. The change should be such that the condition will eventually become false so the loop will terminate. The modification is performed during each iteration *after* the body is executed.

Notice that the last part (*modification*) is not following by a semicolon; semicolons are used strictly to separate the three parts.

for Statement Description

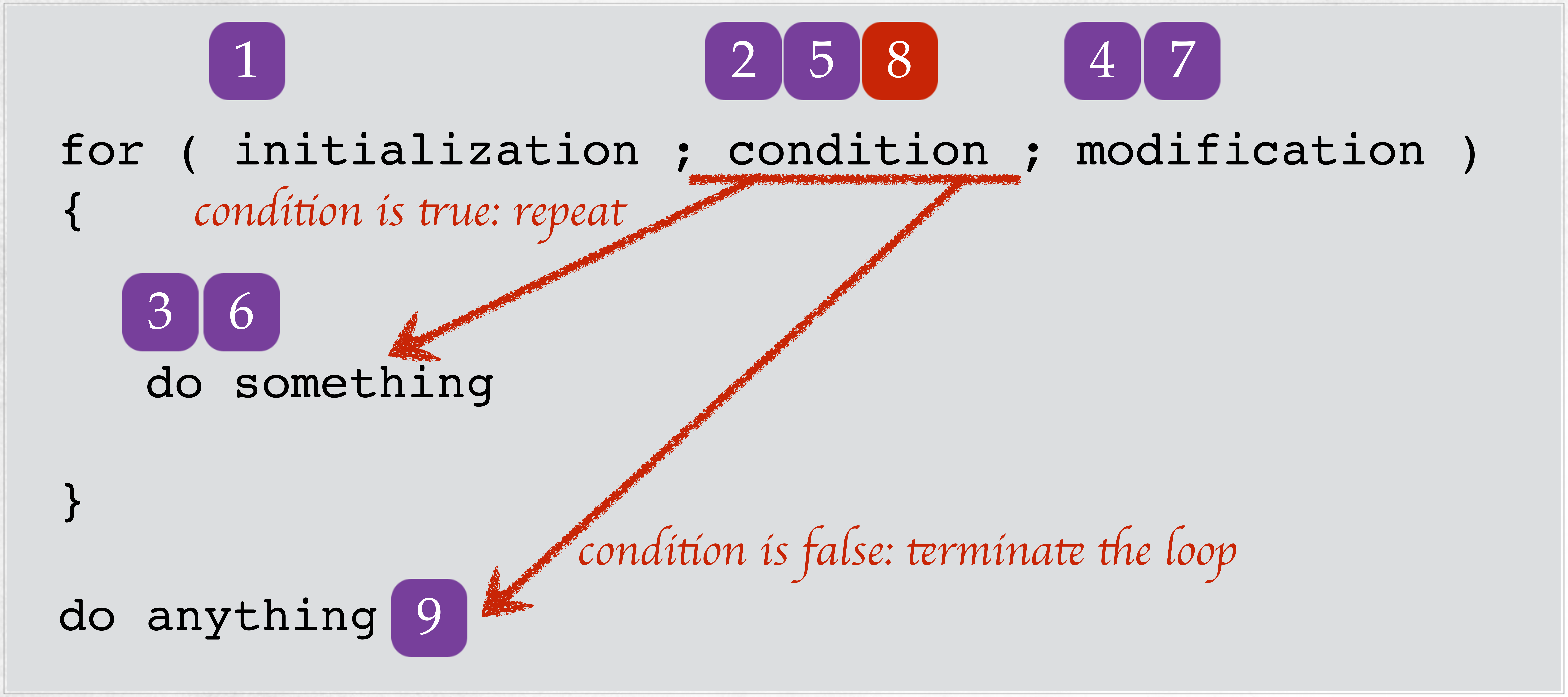


```
initialization
while ( condition ) {
        statement
        modification
}
```



```
for ( initialization ; condition ; modification )
      statement
```

Loop Sequence in *for* Statement



```
for ( initialization ; condition ; modification )
{
    do something
}
do anything
```

1
2
5
8
4
7
condition is true: repeat
3
6
condition is false: terminate the loop
9

For example: if (condition) is false at sequence ‘8’ then
 Terminate the *for* loop statement,
 Execute the next line (of *for* loop statement).

Example using *for* Statement

Listing 7.4: forcounttofive.cpp

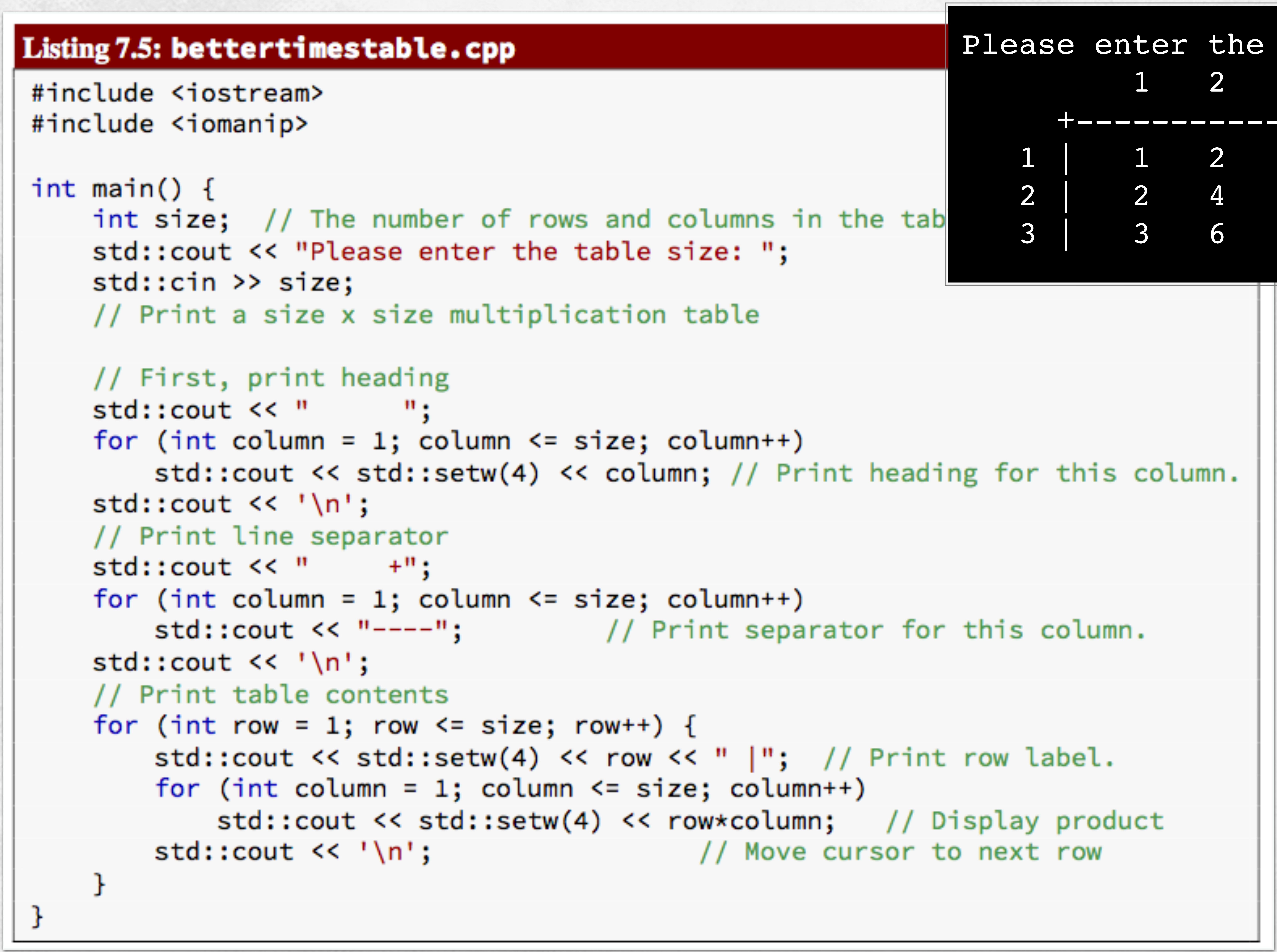
```
#include <iostream>

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

Example using *nested-for* Statement

Listing 7.5: bettertimestable.cpp

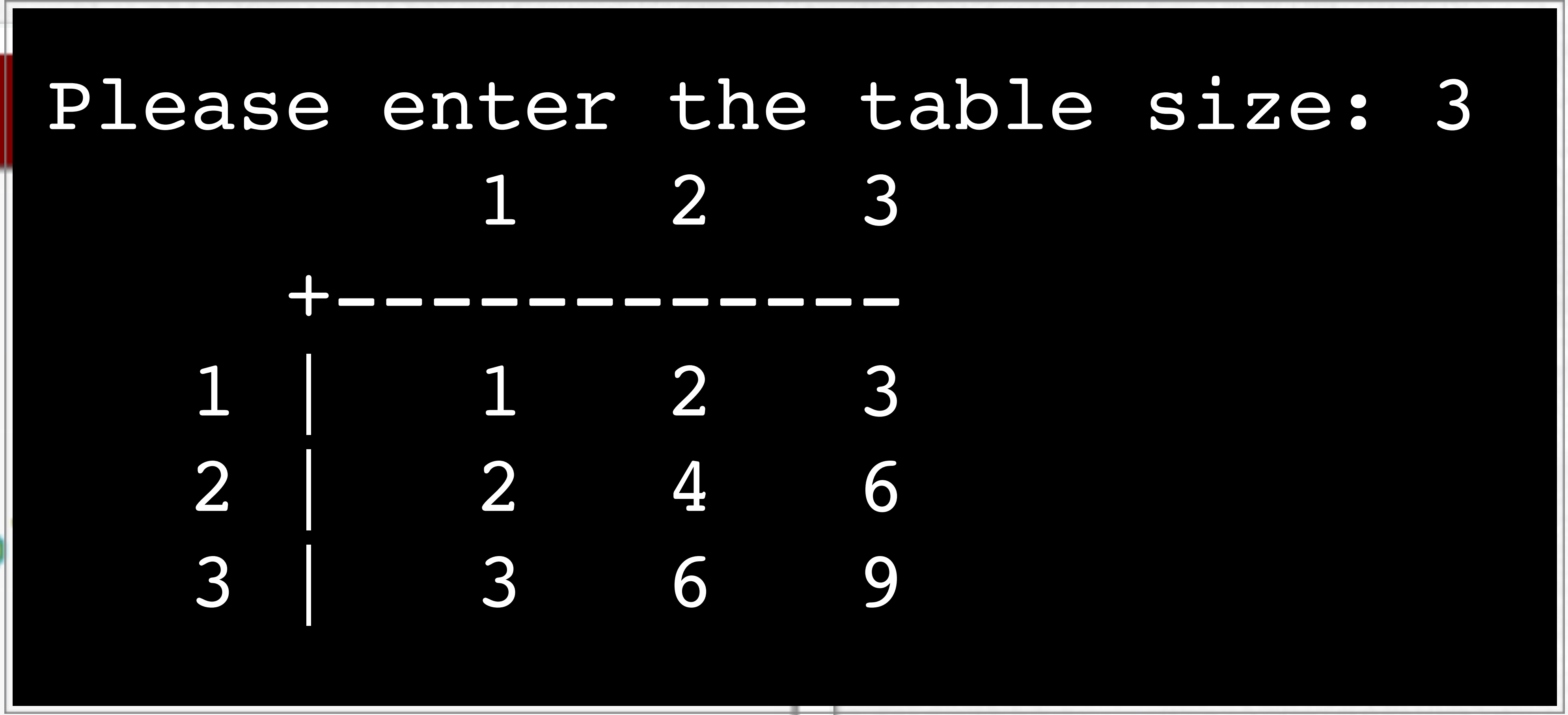
```cpp
#include <iostream>
#include <iomanip>

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

    // First, print heading
    std::cout << "      ";
    for (int column = 1; column <= size; column++)
        std::cout << std::setw(4) << column; // Print heading for this column.
    std::cout << '\n';
    // Print line separator
    std::cout << "     +";
    for (int column = 1; column <= size; column++)
        std::cout << "----";         // Print separator for this column.
    std::cout << '\n';
    // Print table contents
    for (int row = 1; row <= size; row++) {
        std::cout << std::setw(4) << row << " |";  // Print row label.
        for (int column = 1; column <= size; column++)
            std::cout << std::setw(4) << row*column;   // Display product
        std::cout << '\n';                 // Move cursor to next row
    }
}
```

Example using *nested-for* Statement



Listing 7.5: bettertimestable.cpp

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

int main() {
    int size;  // The number of rows and columns in the tab
    std::cout << "Please enter the table size: ";
    std::cin >> size;
    // Print a size x size multiplication table

    // First, print heading
    std::cout << "      ";
    for (int column = 1; column <= size; column++)
        std::cout << std::setw(4) << column; // Print heading for this column.
    std::cout << '\n';
    // Print line separator
    std::cout << "     +";
    for (int column = 1; column <= size; column++)
        std::cout << "----";          // Print separator for this column.
    std::cout << '\n';
    // Print table contents
    for (int row = 1; row <= size; row++) {
        std::cout << std::setw(4) << row << " |";  // Print row label.
        for (int column = 1; column <= size; column++)
            std::cout << std::setw(4) << row*column;   // Display product
        std::cout << '\n';                          // Move cursor to next row
    }
}
```



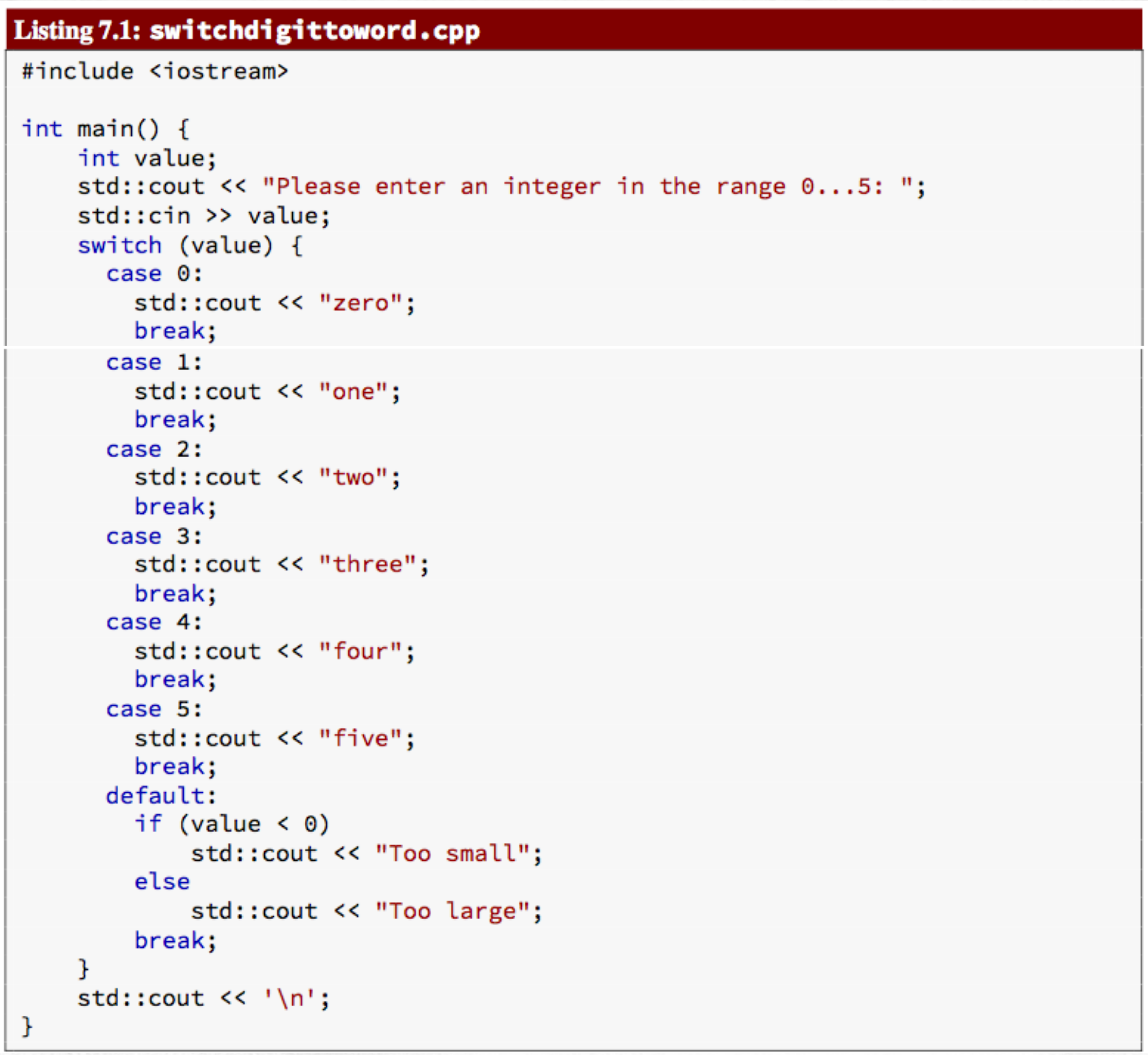
```
Please enter the table size: 3
         1   2   3
     +------------
   1 |   1   2   3
   2 |   2   4   6
   3 |   3   6   9
```

Solution for Nested if-else Statements

```
switch ( integral expression ) {
    case integral constant 1 :
        statement sequence 1
        break;
    case integral constant 2 :
        statement sequence 2
        break;
    case integral constant 3 :
        statement sequence 3
        break;
          ⋮
    case integral constant n :
        statement sequence n
        break;
    default:
        default statement sequence
}
```

```
if ( integral-expression is integral-constant-1 ) then:
    execute statement-sequence-1;
else if ( integral-expression is integral-constant-2 ) then:
    execute statement-sequence-2;
else if ( integral-expression is integral-constant-3 ) then:
    execute statement-sequence-3;
… // skip statements
else if ( integral-expression is integral-constant-n ) then:
    execute statement-sequence-n;
else
    execute default-statement-sequence;
```

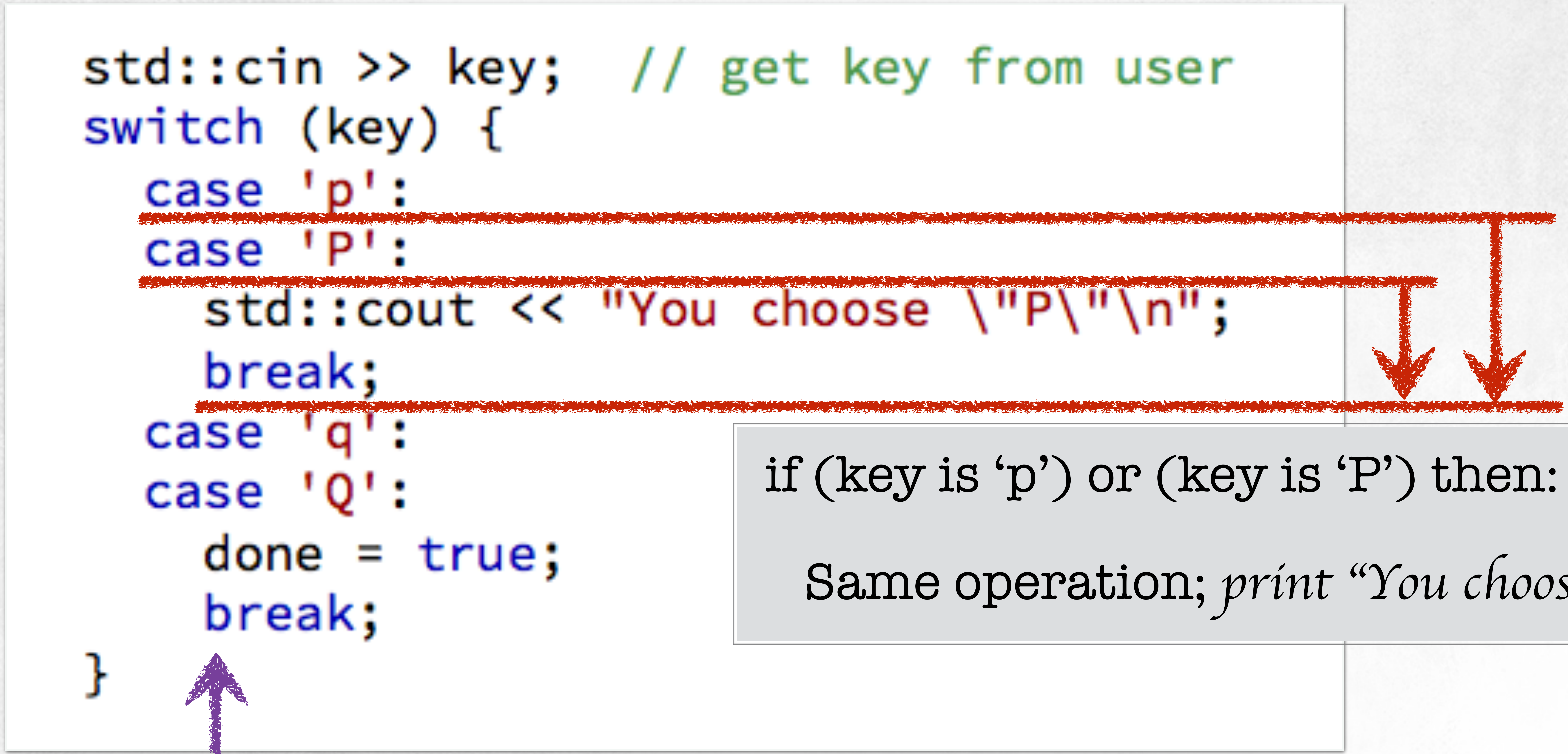
Example for *switch* Statements



Listing 7.1: switchdigittoword.cpp

```
#include <iostream>

int main() {
    int value;
    std::cout << "Please enter an integer in the range 0...5: ";
    std::cin >> value;
    switch (value) {
      case 0:
        std::cout << "zero";
        break;
      case 1:
        std::cout << "one";
        break;
      case 2:
        std::cout << "two";
        break;
      case 3:
        std::cout << "three";
        break;
      case 4:
        std::cout << "four";
        break;
      case 5:
        std::cout << "five";
        break;
      default:
        if (value < 0)
            std::cout << "Too small";
        else
            std::cout << "Too large";
        break;
    }
    std::cout << '\n';
}
```

Role of *break* in *switch* Statements



```
std::cin >> key;  // get key from user
switch (key) {
  case 'p':
  case 'P':
    std::cout << "You choose \"P\"\n";
    break;
  case 'q':
  case 'Q':
    done = true;
    break;
}
```

if (key is ‘p’) or (key is ‘P’) then:

Same operation; *print “You choose \”P”\n”;*

default: is not mandatory

Nested Statements Example

- Code Review: Listing 7.6 in Textbook

Read, Estimate, Execute !!

Object Oriented Programming by C++

Sungwon Lee / Professor

Email: drsungwon@khu.ac.kr

Web: http://mobilelab.khu.ac.kr/

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