

Chapter 5 Smith Exercises & Labs

Exercise 5-1.

1. `x = 6;`
`y = ++x;`
After this code executes, what is the value of **x** and **y**?
`x = 7`
`y = 7`
2. `x = 6;`
`y = x++;`
After this code executes, what is the value of **x** and **y**?
`x = 7`
`y = 6`
3. `x = 6;`
`y = --x;`
After this code executes, what is the value of **x** and **y**?
`x = 5`
`y = 5`
4. `x = 6;`
`y = x--;`
After this code executes, what is the value of **x** and **y**?
`x = 5`
`y = 6`

Exercise 5-2.

1. What is the loop control variable? What is the sentinel value?
Variable is numTimes, sentinel value is 8
2. What is the output?
There is no output because numTimes can never be less than NUM_LOOPS
3. What is the output if the code is changed to **while(numTimes++ <= NUM_LOOPS)?**
Value of numTimes is 9
4. What is the output if the code is changed to **while(++numTimes <= NUM_LOOPS)?**
There is no output because numTimes can never be less than or equal to NUM_LOOPS

Exercise 5-3.

1. What is the value of **number1** when the loop exits?
6
2. What is the value of **number2** when the loop exits?
21
3. If the statement **number1++** is changed to **++number1**, what is the value of **number1** when the loop exits?
6
4. What could you do to force the value of **number2** to be **21** when the loop exits?
Make number2 = 21

Lab 5-1.

The screenshot shows a C++ IDE with a source code editor on the left and a console window on the right. The source code is as follows:

```
1  #include <iostream>
2  #include <string>
3  using namespace std;
4  int main()
5  {
6      string head1 = "Number: ";
7      string head2 = "Multiplied by 2: ";
8      string head3 = "Multiplied by 10: ";
9      int numberCounter = 0;
10     int byTen;
11     int byTwo;
12     const int NUM_LOOPS = 10;
13
14     cout << "0 through 10 multiplied by 2 and by 10." << endl << endl;
15
16     while(numberCounter <= NUM_LOOPS)
17     {
18         byTwo = numberCounter * 2;
19         byTen = numberCounter * 10;
20         cout << head1 << numberCounter << endl;
21         cout << head2 << byTwo << endl;
22         cout << head3 << byTen << endl << endl;
23         ++numberCounter;
24     }
25
26     cout << endl << "Code by Jacob Smetana" << endl;
27     return 0;
28 }
29
```

The console window displays the output of the program:

```
0 through 10 multiplied by 2 and by 10.
Number: 0
Multiplied by 2: 0
Multiplied by 10: 0
Number: 1
Multiplied by 2: 2
Multiplied by 10: 10
Number: 2
Multiplied by 2: 4
Multiplied by 10: 20
Number: 3
Multiplied by 2: 6
Multiplied by 10: 30
Number: 4
Multiplied by 2: 8
Multiplied by 10: 40
Number: 5
Multiplied by 2: 10
Multiplied by 10: 50
Number: 6
Multiplied by 2: 12
Multiplied by 10: 60
Number: 7
Multiplied by 2: 14
Multiplied by 10: 70
Number: 8
Multiplied by 2: 16
Multiplied by 10: 80
Number: 9
Multiplied by 2: 18
Multiplied by 10: 90
Number: 10
Multiplied by 2: 20
Multiplied by 10: 100
Code by Jacob Smetana
Process returned 0 (0x0)   execution time : 0.015 s
Press any key to continue.
```

Exercise 5-4.

1. What is the output if the user enters a **3**?

Page Number 1

Page Number 2

Page Number 3

Value of counter is 4

2. What is the problem with this code, and how can you fix it?

The counter variable ends as one more than the total number of pages to print.

Add **counter--** after the while loop

3. Assuming you fix the problem, if the user enters **50** as the number of pages to print, what is the value of **counter** when the loop exits?

50

4. Assuming you fix the problem, if the user enters **0** as the number of pages to print, how many pages will print?

0

5. What is the output if the curly braces are deleted?

Deleting the curly braces results in an infinite loop unless 0 is entered instead.

Lab 5-2.

```
5-2.cpp x
1  #include <iostream>
2  #include <string>
3  using namespace std;
4
5  int main()
6  {
7      double numStars = 0;
8      double averageStars;
9      double totalStars = 0;
10     int numPatrons = 0;
11
12     while(numStars >= 0)
13     {
14         ++numPatrons;
15         cout << "Enter rating for featured movie: ";
16         cin >> numStars;
17         totalStars += numStars;
18     }
19
20     averageStars = (totalStars - numStars) / (numPatrons - 1);
21
22     cout << endl << "Average Star Value: " << averageStars << endl << endl;
23     cout << endl << "Code By Jacob Smetana"<< endl;
24     return 0;
25 }
26
27
```

"C:\Users\Nii-san\Desktop\prog fund 1\Chapter 5\Smith Exercises & Labs\Lab 5-2.exe"

```
Enter rating for featured movie: 0
Enter rating for featured movie: 3
Enter rating for featured movie: 4
Enter rating for featured movie: 4
Enter rating for featured movie: 1
Enter rating for featured movie: 1
Enter rating for featured movie: 2
Enter rating for featured movie: -1

Average Star Value: 2.14286

Code By Jacob Smetana

Process returned 0 (0x0)   execution time : 7.345 s
Press any key to continue.
```

Exercise 5-5.

1. The loop executes 12 times.
False
2. This loop could be written as a **while** loop.
True
3. Changing the \leq operator to $<$ will make no difference in the output.
True
4. This loop executes 6 times.
True

Lab 5-3.

The screenshot shows a C++ IDE with a file named 5-3.cpp. The code is as follows:

```
1 #include <iostream>
2 #include <string>
3 using namespace std;
4 int main()
5 {
6
7     string head1 = "Number: ";
8     string head2 = "Multiplied by 2: ";
9     string head3 = "Multiplied by 10: ";
10    int numberCounter;
11    int byTen;
12    int byTwo;
13    const int NUM_LOOPS = 10;
14
15    cout << "0 through 10 multiplied by 2 and by 10." << endl << endl;
16
17    for(numberCounter = 0; numberCounter <= NUM_LOOPS; ++numberCounter)
18    {
19        byTwo = numberCounter * 2;
20        byTen = numberCounter * 10;
21        cout << head1 << numberCounter << endl;
22        cout << head2 << byTwo << endl;
23        cout << head3 << byTen << endl << endl;
24    }
25
26    cout << endl << "Code by Jacob Smetana" << endl;
27    return 0;
28 }
29
```

The output of the program is displayed in a separate window, showing the following text:

```
0 through 10 multiplied by 2 and by 10.
Number: 0
Multiplied by 2: 0
Multiplied by 10: 0
Number: 1
Multiplied by 2: 2
Multiplied by 10: 10
Number: 2
Multiplied by 2: 4
Multiplied by 10: 20
Number: 3
Multiplied by 2: 6
Multiplied by 10: 30
Number: 4
Multiplied by 2: 8
Multiplied by 10: 40
Number: 5
Multiplied by 2: 10
Multiplied by 10: 50
Number: 6
Multiplied by 2: 12
Multiplied by 10: 60
Number: 7
Multiplied by 2: 14
Multiplied by 10: 70
Number: 8
Multiplied by 2: 16
Multiplied by 10: 80
Number: 9
Multiplied by 2: 18
Multiplied by 10: 90
Number: 10
Multiplied by 2: 20
Multiplied by 10: 100
Code by Jacob Smetana
Process returned 0 (0x0)   execution time : 0.027 s
```

The IDE also shows a message window with the following text:

```
Line Message
=== Build file: "no target" in "no project" (code)
=== Build finished: 0 error(s), 0 warning(s) (code)
```

Exercise 5-6.

1. How many times does this loop execute?
3 times
2. What is the output of this program?
Strike 1
Strike 2
Strike 3
3. Is the output different if you change the order of the statements in the body of the loop, so that **counter++** comes after the output statement?
Yes. The output becomes: Strike 0
Strike 1
Strike 2
4. What is the loop control variable?
counter

Lab 5-4.

```
1 #include <iostream>
2 #include <string>
3 using namespace std;
4 int main()
5 {
6
7     string head1 = "Number: ";
8     string head2 = "Multiplied by 2: ";
9     string head3 = "Multiplied by 10: ";
10    int numberCounter = 0;
11    int byTen;
12    int byTwo;
13    const int NUM_LOOPS = 10;
14
15    cout << "0 through 10 multiplied by 2 and by 10." << endl << endl;
16
17    do
18    {
19        byTwo = numberCounter * 2;
20        byTen = numberCounter * 10;
21        cout << head1 << numberCounter << endl;
22        cout << head2 << byTwo << endl;
23        cout << head3 << byTen << endl << endl;
24        ++numberCounter;
25    }
26    while(numberCounter <= NUM_LOOPS);
27
28    cout << "Code by Jacob Smetana" << endl;
29    return 0;
30 }
31
```

0 through 10 multiplied by 2 and by 10.

Number: 0
Multiplied by 2: 0
Multiplied by 10: 0

Number: 1
Multiplied by 2: 2
Multiplied by 10: 10

Number: 2
Multiplied by 2: 4
Multiplied by 10: 20

Number: 3
Multiplied by 2: 6
Multiplied by 10: 30

Number: 4
Multiplied by 2: 8
Multiplied by 10: 40

Number: 5
Multiplied by 2: 10
Multiplied by 10: 50

Number: 6
Multiplied by 2: 12
Multiplied by 10: 60

Number: 7
Multiplied by 2: 14
Multiplied by 10: 70

Number: 8
Multiplied by 2: 16
Multiplied by 10: 80

Number: 9
Multiplied by 2: 18
Multiplied by 10: 90

Number: 10
Multiplied by 2: 20
Multiplied by 10: 100

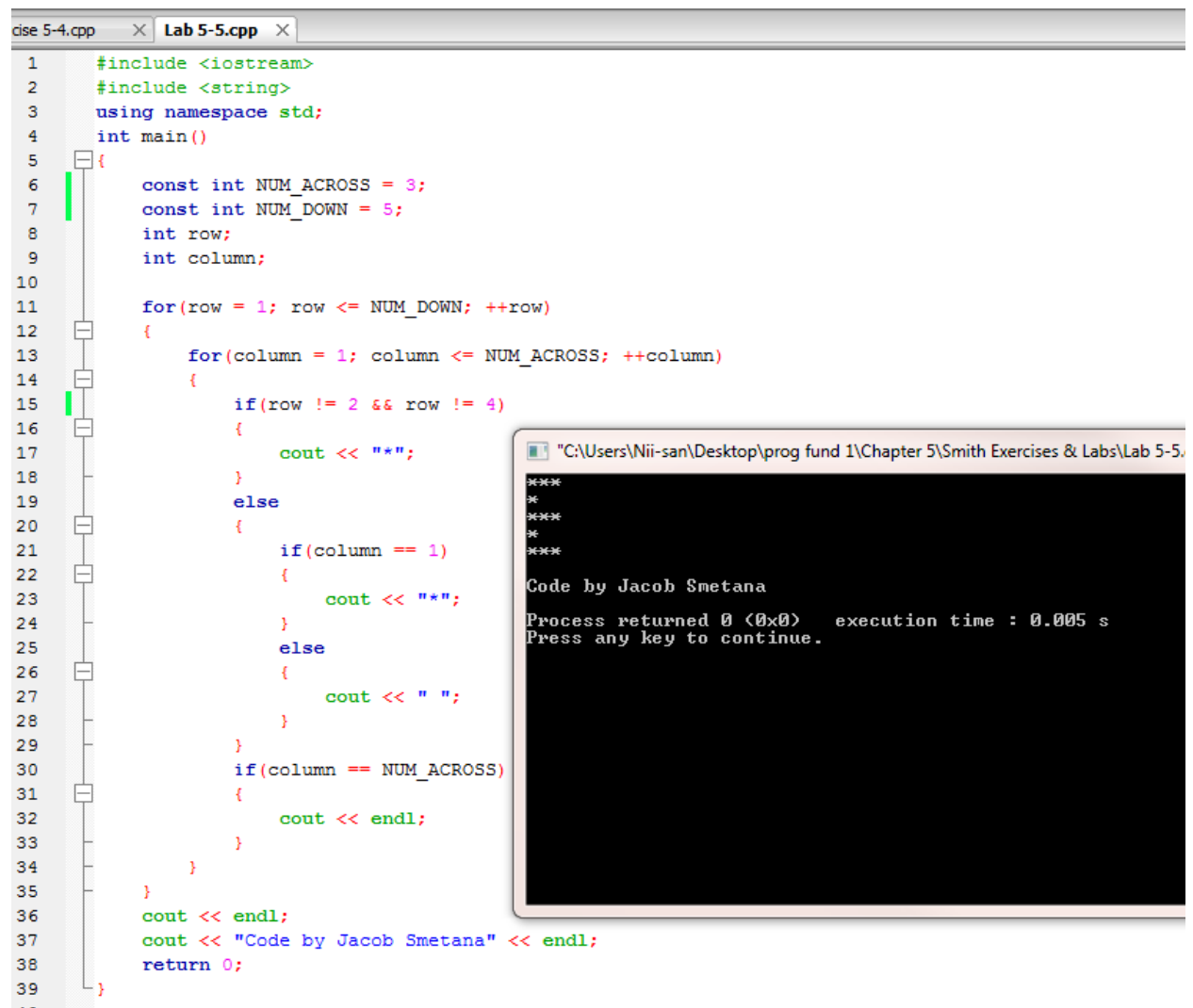
Code by Jacob Smetana

Process returned 0 (0x0) execution time : 0.015 s
Press any key to continue.

Exercise 5-7.

1. How many times does the outer loop execute?
5 times
2. How many times does the inner loop execute?
7 times
3. What is the value of **sum** printed by **cout**?
175
4. What would happen if you changed **rows++** and **columns++** to **++rows** and **++columns**?
Nothing changes

Lab 5-5.



The screenshot shows a C++ IDE with two windows. The main window, titled 'Lab 5-5.cpp', contains the following code:

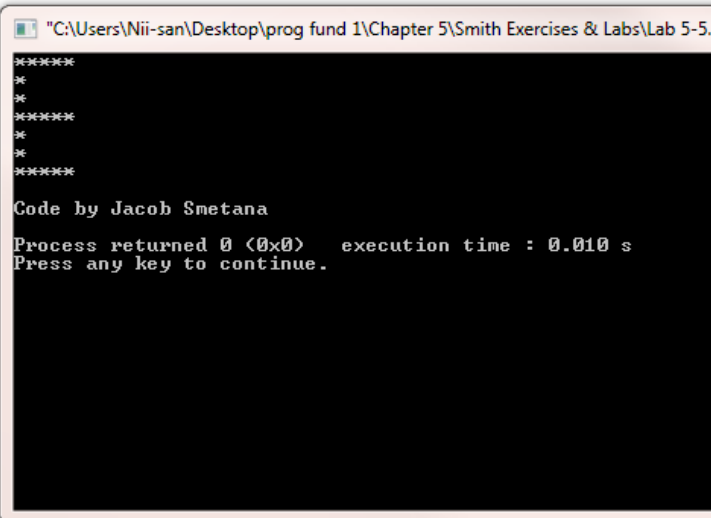
```
1  #include <iostream>
2  #include <string>
3  using namespace std;
4  int main()
5  {
6      const int NUM_ACROSS = 3;
7      const int NUM_DOWN = 5;
8      int row;
9      int column;
10
11     for(row = 1; row <= NUM_DOWN; ++row)
12     {
13         for(column = 1; column <= NUM_ACROSS; ++column)
14         {
15             if(row != 2 && row != 4)
16             {
17                 cout << " * ";
18             }
19             else
20             {
21                 if(column == 1)
22                 {
23                     cout << " * ";
24                 }
25                 else
26                 {
27                     cout << "  ";
28                 }
29             }
30             if(column == NUM_ACROSS)
31             {
32                 cout << endl;
33             }
34         }
35     }
36     cout << endl;
37     cout << "Code by Jacob Smetana" << endl;
38     return 0;
39 }
```

The output window, titled '"C:\Users\Nii-san\Desktop\prog fund 1\Chapter 5\Smith Exercises & Labs\Lab 5-5"', shows the following output:

```
****
*
****
*
****
Code by Jacob Smetana
Process returned 0 (0x0)   execution time : 0.005 s
Press any key to continue.
```

Lab 5-5 Step 7.

```
5-5.cpp x
1  #include <iostream>
2  #include <string>
3  using namespace std;
4  int main()
5  {
6      const int NUM_ACROSS = 5;
7      const int NUM_DOWN = 7;
8      int row;
9      int column;
10
11     for(row = 1; row <= NUM_DOWN; ++row)
12     {
13         for(column = 1; column <= NUM_ACROSS; ++column)
14         {
15             if(row == 1 || row == 4 || row == 7)
16             {
17                 cout << "*";
18             }
19             else
20             {
21                 if(column == 1)
22                 {
23                     cout << "*";
24                 }
25                 else
26                 {
27                     cout << " ";
28                 }
29             }
30             if(column == NUM_ACROSS)
31             {
32                 cout << endl;
33             }
34         }
35     }
36     cout << endl;
37     cout << "Code by Jacob Smetana" << endl;
38     return 0;
39 }
```



```
*****
*
*
*****
*
*
*****
Code by Jacob Smetana
Process returned 0 (0x0) execution time : 0.010 s
Press any key to continue.
```


Exercise 5-8.

1. What happens when you compile this program if the variable **sum** is not initialized with the value 0?
Nothing changes
2. Could you replace **sum += rainfall;** with **sum = sum + rainfall;** ?
Yes, you could
3. The variables **sum**, **rainfall**, and **average** should be declared to be what data type to calculate the most accurate average rainfall?
double
4. Could you replace **DAYS_IN_WEEK** in the statement **average = sum / DAYS_IN_WEEK;** with the variable named **counter** and still get the desired result? Explain.
You would not get the desired result because **counter** would equal **8** at the end of the program.

Lab 5-6.

```
5-6.cpp X
1 // Input: L for left-handed; R for right handed; X to quit.
2 #include <iostream>
3 #include <string>
4 using namespace std;
5 int main()
6 {
7     string leftOrRight = "";
8     int rightTotal = 0;
9     int leftTotal = 0;
10
11     cout << "Enter an L if you are left-handed,";
12     cout << " an R if you are right-handed or X to quit: " << endl;
13     cin >> leftOrRight;
14
15     while(leftOrRight == "R" || leftOrRight == "L")
16     {
17         if(leftOrRight == "R")
18         {
19             rightTotal++;
20         }
21         else
22         {
23             leftTotal++;
24         }
25         cin >> leftOrRight;
26     }
27
28     cout << endl << "Number of left-handed students: " << leftTotal << endl;
29     cout << "Number of right-handed students: " << rightTotal << endl;
30     cout << endl << "Code by Jacob Smetana" << endl;
31
32     return 0;
33 }
34
35 "C:\Users\Nii-san\Desktop\prog fund 1\Chapter 5\Smith Exercises & Labs\Lab 5-6.exe"
36 Enter an L if you are left-handed, an R if you are right-handed or X to quit:
37 R
R
R
L
L
L
L
R
L
R
R
R
L
X
Number of left-handed students: 5
Number of right-handed students: 6
Code by Jacob Smetana
Process returned 0 (0x0) execution time : 22.830 s
Press any key to continue.
```

Exercise 5-9.

1. You plan to use the following statement in a C++ program to validate user input:

while(inputString == "")

What would your user enter to cause this test to be true?

Nothing. User just presses Enter.

2. You plan to use the following statement in a C++ program to validate user input:

while(userAnswer == "N" || userAnswer == "n")

What would a user enter to cause this test to be true?

User could enter either an uppercase or lowercase *n*.

3. You plan to use the following statement in a C++ program to validate user input:

while(userAnswer < 1 || userAnswer > 10)

What would a user enter to cause this test to be true?

User could enter any number less than 1 or greater than 10 but none including or in between 1 and 10.

Lab 5-7.

```

5-7.cpp x
7 {
8     int number;           // Number to be guessed
9     int userNumber;       // User's guess
10    string keepGoing;      // Contains a "Y" or "N" determining if the user wants to continue
11
12    srand((unsigned)time(NULL));
13    number = (rand() % 10) + 1; // Generate random number
14
15    cout << "Do you want to guess a number? Enter Y or N: ";
16    cin >> keepGoing;
17    cout << endl;
18    //Validate input
19    while(keepGoing != "Y" && keepGoing != "N")
20    {
21        cout << "Invalid response. Please enter Y or N: ";
22        cin >> keepGoing;
23        cout << endl;
24    }
25
26    while(keepGoing == "Y")
27    {
28        cout << "I'm thinking of a number. \n Try to guess by entering a number between 1 and 10: ";
29        cin >> userNumber;
30        //Validate input
31        while(userNumber < 1 || userNumber > 10)
32        {
33            cout << "Number must be between 1 and 10. Please try again: ";
34            cin >> userNumber;
35            cout << endl;
36        }
37        if(userNumber == number)
38        {
39            keepGoing = "N";
40            cout << "You are a genius. That's correct!" << endl;
41        }
42        else
43        {
44            cout << "That's not correct. Do you want to guess again? Enter Y or N: ";
45            cin >> keepGoing;
46            cout << endl;
47            // Validate input
48            while(keepGoing != "Y" && keepGoing != "N")
49            {
50                cout << "Invalid response. Please enter Y or N: ";
51                cin >> keepGoing;
52                cout << endl;
53            }
54        }
55    }
56    cout << endl << "Code by Jacob Smetana" << endl;
57

```

others

Chapter

"C:\Users\Nii-san\Desktop\prog fund 1\Chapter 5\Smith Exercises & Labs\Lab 5-7.exe"

```

Do you want to guess a number? Enter Y or N: y
Invalid response. Please enter Y or N: n
Invalid response. Please enter Y or N: Y
I'm thinking of a number. .
Try to guess by entering a number between 1 and 10: 22
Number must be between 1 and 10. Please try again: 7
That's not correct. Do you want to guess again? Enter Y or N: Y
I'm thinking of a number. .
Try to guess by entering a number between 1 and 10: 5
You are a genius. That's correct!
Code by Jacob Smetana
Process returned 0 (0x0)   execution time : 12.028 s
Press any key to continue.

```

Windows