Lab 4

LAB 4.1   Relational Operators and the if Statement

Bring in the file initialize.cpp from the Lab 4 folder. The code is listed below:

```cpp
// This program tests whether or not an initialized value
// is equal to a value input by the user

// PLACE YOUR NAME HERE

#include <iostream>
using namespace std;

int main()
{
   int num1, // num1 is not initialized
   num2 = 5; // num2 has been initialized to 5

   cout << "Please enter an integer" << endl;
   cin >> num1;

   cout << "num1 = " << num1 << " and num2 = " << num2 << endl;

   if (num1 = num2)
      cout << "Hey, that's a coincidence!" << endl;

   if (num1 != num2)
      cout << "The values are not the same" << endl;

   return 0;
}
```

Exercise 1
Run the program several times using a different input each time. Does the program do what you expect? Is so, explain what it is doing. If not, locate the error and fix it.

Exercise 2
Modify the program so that the user inputs both values to be tested for equality. Make sure you have a prompt for each input. Test the program with pairs of values that are the same and that are different.

Exercise 3
Modify the program so that when the numbers are the same it prints the following lines:
The values are the same. Hey that's a coincidence!

Exercise 4
Modify the revised Exercise 3 program by replacing the two if statements with a single if/else statement. Run the program again to test the results.

LAB 4.2   if/else if Statements

Bring in the file grades.cpp from the Lab 4 folder. The code follows:

```
// This program prints "You Pass" if a student's average is
// 60 or higher and prints "You Fail" otherwise

// PLACE YOUR NAME HERE

#include <iostream>
using namespace std;

int main()
{
   float average;    // holds the grade average

   cout << "Input your average:" << endl;
   cin >> average;

   if (average > 60)
      cout << "You Pass" << endl;

   if (average < 60)
      cout << "You Fail" << endl;

   return 0;
}
```

Exercise 1
Run the program three times using 80, 55 and 60 for the average. What happens when you input 60 as the average? Modify the first if statement so that the program will also print "You Pass" if the average equals 60.

Exercise 2
Modify the program so that it uses an if/else statement rather than two if statements.

Exercise 3
Modify the program from Exercise 2 to allow the following categories: Invalid data (data above 100), 'A' category (90–100), 'B' category (80–89), "You Pass" category (60–79), "You Fail" category (0–59).

What will happen to your program if you enter a negative value such as -12?

LAB 4.3   Logical Operators

Retrieve LogicalOp.cpp from the Lab 4 folder. The code is as follows:

```
// This program illustrates the use of logical operators

// PLACE  YOUR NAME HERE

#include <iostream>
using namespace std;

int main()
{
   char year;
   float gpa;

   cout << "What year student are you ?" << endl;
   cout << "Enter 1 (freshman), 2 (sophomore), 3 (junior), or 4 (senior)"
   << endl << endl;
   cin >> year;

   cout << "Now enter your GPA" << endl;
```

```
   cin >> gpa;

   if (gpa >= 2.0 && year == '4')
      cout << "It is time to graduate soon" << endl;

   else if (year != '4' || gpa <2.0)
      cout << "You need more schooling" << endl;

   return 0;
}
```

Exercise 1
How could you rewrite `gpa >= 2.0` in the first if statement using the NOT operator?

Exercise 2
Could you replace `year !='4'` in the `else if` statement with `year<4` or `year<=3`? Why or why not?

Exercise 3
If you replace
```
   if ( gpa >= 2.0 && year == '4')
```
with
```
   if ( gpa >= 2.0 || year == '4')
```
and replace
```
   else if ( year != '4'|| gpa < 2.0)
```
with
```
   else if ( year != '4' && gpa < 2.0)
```

which students will graduate and which will not graduate according to this new program?

Does this handle all cases (i.e., all combinations of `year` and `gpa`)?

Exercise 4
Could you replace `else if ( year != '4'|| gpa < 2.0)` with the
single word `else`?

LAB 4.4   The `switch` Statement

Exercise 1
Bring in the file `switch.cpp` from the Lab 4 folder. The code is shown below. Remove the break
statements from each of the cases. What is the effect on the execution of the program?

```
// This program illustrates the use of the switch statement.

// PLACE YOUR NAME HERE

#include <iostream>
using namespace std;

int main()
{
   char grade;

   cout << "What grade did you earn in Programming I ?" << endl;
   cin >> grade;

   switch (grade)   // This is where the switch statement begins
   {
      case 'A': cout << "an A - excellent work !" << endl;
               break;
```

```
        case 'B': cout << "you got a B - good job" << endl;
                  break;
        case 'C': cout << "earning a C is satisfactory" << endl;
                  break;
        case 'D': cout << "while D is passing, there is a problem" << endl;
                  break;
        case 'F': cout << "you failed - better luck next time" << endl
                  break;
        default: cout << "You did not enter an A, B, C, D, or F" << endl;
    }

    return 0;
}
```

Exercise 2
Add an additional `switch` statement that allows for a Passing option for a grade of D or better. Use the sample run given below to model your output.

Sample Run:

```
What grade did you earn in Programming I ?
A
YOU PASSED!
an A - excellent work!
```

Exercise 3
Exercise 3: Rewrite the program `switch.cpp` using `if` and `else if` statements rather than a `switch` statement. Did you use a trailing `else` in your new version? If so, what did it correspond to in the original program with the `switch` statement?

LAB 4.5   Student Generated Code Assignments

Option 1: Write a program that prompts the user for their quarterly water bill for the last four quarters. The program should find and output their average monthly water bill. If the average bill exceeds $75, the output should include a message indicating that too much water is being used. If the average bill is at least $25 but no more than $75, the output should indicate that a typical amount of water is being used. Finally, if the average bill is less than $25, the output should contain a message praising the user for conserving water. Use the sample run below as a model for your output.

Sample Run 1:

```
Please input your water bill for quarter 1:
300
Please input your water bill for quarter 2:
200
Please input your water bill for quarter 3:
225
Please input your water bill for quarter 4:
275
Your average monthly bill is $83.33. You are using excessive amounts of water
```

Sample Run 2:

```
Please input your water bill for quarter 1:
100
Please input your water bill for quarter 2:
150
```

```
Please input your water bill for quarter 3:
75
Please input your water bill for quarter 4:
125
Your average monthly bill is $37.50. You are using a typical amount of water
```

Option 2: The local t-shirt shop sells shirts that retail for $12. Quantity discounts are given as follow:

Number of Shirts	Discount
5–10	10%
11–20	15%
21–30	20%
31 or more	25%

Write a program that prompts the user for the number of shirts required and then computes the total price. Make sure the program accepts only nonnegative input. Use the following sample runs to guide you:

Sample Run 1:

```
How many shirts would you like ?
4
The cost per shirt is $12 and the total cost is $48
```

Sample Run 2:

```
How many shirts would you like ?
0
The cost per shirt is $12 and the total cost is $0
```

Sample Run 3:

```
How many shirts would you like ?
8
The cost per shirt is $10.80 and the total cost is $86.40
```

Sample Run 4:

```
How many shirts would you like ?
-2
Invalid Input: Please enter a nonnegative integer
```

Option 3: The University of Guiness charges $3000 per semester for in-state tuition and $4500 per semester for out-of-state tuition. In addition, room and board is $2500 per semester for in-state students and $3500 per semester for out-of-state students. Write a program that prompts the user for their residential status (i.e., in-state or out-of-state) and whether they require room and board (Y or N). The program should then compute and output their bill for that semester. Use the sample output below:

Sample Run 1:

```
Please input "I" if you are in-state or "O" if you are out-of-state:
I
Please input "Y" if you require room and board and "N" if you do not:
N
Your total bill for this semester is $3000
```

Sample Run 2:

```
Please input "I" if you are in-state or "O" if you are out-of-state:
O
```

```
Please input "Y" if you require room and board and "N" if you do not:
Y
Your total bill for this semester is $8000
```