Lab: For Loop

Tutorial Lab 1: Using the For Loop

Copy the code below into the text editor on the left. Then click on the `TRY IT` button to see the resulting output and ++Code Visualizer++ link (below) to see how the program runs line by line.

```
for (int x = 0; x < 11; x++) {
  if (x % 2 == 0) {
    cout << "Even" << endl;
  }
  else {
    cout << "Odd" << endl;
  }
}
```

Code Visualizer

Program Summary

1. The `for` loop runs through all the values of the variable `x` from 0 to 10 as specified in the loop header.
2. For each value of `x`, an expression is evaluated using a conditional `if` statement.
3. If `x` modulo `2` evaluates to 0, then print `Even` followed by a newline character.
4. If `x` modulo `2` *does not* evaluate to 0, then print `Odd` instead followed by a newline character.

Lab: While Loop

Tutorial Lab 2: The While Loop

Copy the code below into the text editor on the left. Then click on the `TRY IT` button to see the resulting output and ++Code Visualizer++ link (below) to see how the program runs line by line.

```
int counter = 0;
while (counter < 10) {
  cout << counter << endl;
  counter = counter + 1;
}
cout << "while loop ended" << endl;
```

Code Visualizer

Program Summary

1. A `counter` variable is initialized to keep track of how many times the loop will be executed.
2. The loop will run as long as `counter` is less than 10.
3. Each time the loop runs, the integer value of `counter` is printed to the screen.
4. The value of `counter` is then incremented by 1.
5. When `counter` reaches `10`, the boolean expression no longer evaluates to true and the program will exit the loop.
6. Before the program terminates, a statement is printed to the screen, indicating that the `while` loop has ended.
7. Recall that the `while` loop must have an exit condition. By incrementing the `counter` variable, we ensure that the loop will eventually end. If we do not increment `counter` in this loop, we will create an *infinite* loop because `counter` will never reach 10 or greater.

Lab: Break Statement

Tutorial Lab 3: Breaking from the While Loop

Copy the code below into the text editor in the upper left panel. Then click on the `TRY IT` button to run the resulting program in the Terminal in the lower left panel.

▼ What does `cin >> input;` do?

The `cin >> input;` command records what a user enters on the screen and stores that information in the variable `input`. Note that `input` is of type `double`.

▼ What do `cin.good()` and `cin.fail()` do?

`cin.good()` checks to see if the input entered by the user was successful while `cin.fail()` checks to see if the input failed. Since `input` is of type `double`, only numerical values entered by the user will cause `cin >> input` to be successful, anything else will cause the input to fail.

```
double result = 0;
double input;

while (true) {
  cout << "Enter a number to add to sum. ";
  cout << "Or enter a non-number to quit and calculate sum." <<
        endl;
  cin >> input;
  if (cin.good()) {
    result += input;
  }
  if (cin.fail()) {
    cout << "Sum = " << result << endl;
    break;
  }
}
```

Program Summary

1. Declare the variable `result` and initialize it to `0`. `result` will store the total of the summation.
2. Declare the variable `input`. `input` will store the information that the user enters.
3. Next we set up a `while` loop with `true` as the expression in the loop

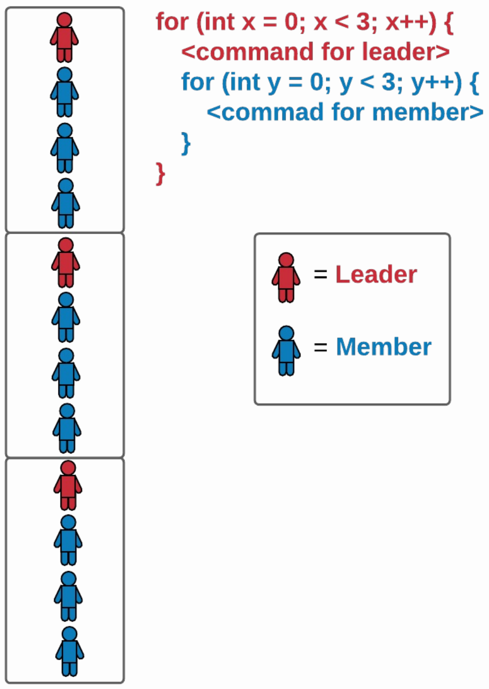
header. We do this because we want the loop to continue running and storing information from the user. Since we don’t know how much information the user will enter, a `while` loop is best for the situation.

4. The user is prompted to enter some information and that information is stored in the variable `input` which was declared earlier.
5. If the information was stored into `input` successfully, the value in `input` will be added to the value in `result`, our total summation.
6. If the information was *not* stored into `input` successfully, then the program will print out the total summation `result` and exit the `while` loop.

Lab Challenge: Loop Patterns

Nested Loop Example

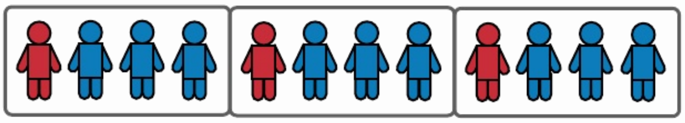
One of the benefits of nested loops is that they can be used to construct complex patterns. Imagine a classroom full of students and they are distributed evenly into smaller groups and asked to form a single line with their groups. The outer loop is like the group leader (represent in **red** and `L`) and the inner loop is like the rest of the group members (represented in **blue** and `M`.



.guides/img/NestedLoopExample

```
for (int x = 0; x < 3; x++) {
  cout << "L" << endl;
  for (int y = 0; y < 3; y++) {
    cout << "M" << endl;
  }
}
```

What is the pattern described by the above example? There are 3 leaders and **each** leader has 3 members. However, note that the example shows the students standing in a *vertical* line. What if you want to arrange the students in a *horizontal* line like this instead?



.guides/img/NestedLoopHorizontal

By removing the `<< endl` commands from the code above, you can accomplish this task. Alternatively, you can also make use of an `if` and `else` statement instead of a nested loop. Both ways will produce the same result.

```
for (int x = 0; x < 3; x++) {
  cout << "L";
  for (int y = 0; y < 3; y++)
        {
    cout << "M";
  }
}
```

```
for (int x = 0; x < 12; x++)
  if ((x == 0) || (x == 4) |
        {
    cout << "L";
  }
  else {
    cout << "M";
```

Nested For Loop Challenge

challenge

Assignment:

For this challenge, you will use your knowledge of **patterns**, **conditionals**, and **nested `for` loops** to produce the following output:

```
XOXOXOXOX
OXO
OXO
XOXOXOXOX
OXO
OXO
XOXOXOXOX
OXO
OXO
```

Requirement:

Your program **must** include **at least two** `for` loops, one nested within another, in order to receive credit. In addition, you are only allowed to use, **at most**, **two** `cout` statements.

▼ **Hint**

You should start by determining a pattern that repeats itself. One noticeable pattern is:

```
XOXOXOXOX
OXO
OXO
```

Try creating that particular pattern first, then iterate that pattern by modifying the existing loop(s).