For Loops

Sections 5.1, 5.6
for loops (5.6)

• Just like a while loop, but more concise!

```cpp
// initialize    test       update
for (count = 0; count < 5; count++)
{
    cout << count << endl;
}
```
For vs While

This for loop

```c++
for (count = 1; count <= 9; count += 3)
{
    cout << count << endl;
}
```

is equivalent to what `while` loop?
Example

- Write a `for` loop that outputs odd integers less than 10 and greater than 0
Practice

• What does this output?

```cpp
for (i = 5; i < 10; i += 2)
{
    cout << i;
}
```

• Rewrite the for loop as a while loop
Problem

• Write code that will print the sum of the odd integers between 1 and 50 inclusive.

• Do this with a for loop

• Do this with a while loop
Practice

• Write a program that computes the factorial of a number. The factorial of a number is given by the formula below. The user will input a value for N.

• \( N! = N \times (N-1) \times (N-2) \times \ldots \times 2 \times 1 \)
  - Where \( 0! = 1, 1! = 1, 2! = 2, 3! = 6, \ldots \)
Localized Declarations

```
for (int i = 0; i < n; i++)
{
    cout << i << endl;
}
cout << i << endl;  // This will cause an error
```

• i is declared ONLY in the loop

• Convert this to a while loop
Potential Pitfalls

• What is the output of the following loop

```cpp
for (count = 0; count < 5; count++)
{
    cout << count << endl;
    count++;  
}
```
Problem

- Write a program that allows the user to enter 20 integers, you should then print out the following:
  - The sum of all integers inputted
  - The average of all integers inputted
  - The largest integer of all integers inputted
Increment and Decrement Operators (5.1)

- C++ provides a shortcut to increment or decrement a variable by 1
  - Always by 1

```cpp
int x = 99;

x++; // this is equivalent to x += 1
x--; // this is equivalent to x -= 1
```
In a Loop

```cpp
int x = 1;
while( x < 5 ){
    cout << " x : " << x << endl;
    x++; // increment
}
```
For more than just loops

- This can be used in an expression:
  \[ y = x++ + 9; \]
  What does this mean?

- This can also be used in a conditional
  \[ (x-- > 9) \]
  What does this mean?
Practice

• Write one statement of code to do each of the following:

```c
int x = 0, y = 1;
```

• Add $x + 9$ to $y$ and increment $x$ by 1

• Add $x * 4$ to $y$ and decrement $x$ by 1
Prefix vs Postfix

- ++x is prefix
  - The x += 1 happens *before* the expression is evaluated

- x++ is postfix
  - the x += 1 happens *after* the expression is evaluated

```c
int y=0, x=0, z=0;
x = y++;
y = ++z;
z = x ++ + 1;
```
Examples

```c
int x = 0, y = 0;

x = y++ * 2;
y = ++x / 2;

x = x++ + 1;
x = ++x + 1;

y = (y + x++) * 2;
x = y++ + ++x;
```
Practice

• Write a single C++ statement to do each of the following:
  \[
  \text{int } y = 0, x = 0, z = 0; \]

• Decrement \(x\) by 1 then add \(2x\) to \(y\)

• Subtract \(9x - 1\) from \(y\) then decrement \(x\) by 1

• Increment \(x\) and \(y\) each by 1 then add \(x+y\) to \(z\)