For Loops

Sections 5.1, 5.6

for loops (5.6)

- Just like a while loop, but more concise!

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

For vs While

This for loop

```
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?

```
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 * (N-1) * (N-2) * ... * 2 * 1`**
  - Where 0! = 1, 1! = 1 , 2! = 2, 3! = 6, …

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

```
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

```
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:

  ```
  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

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

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

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

Examples

```
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:
  ```
  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