Today

- We have looked at a C++ program in some detail
- What were the main components of that program?
- Today we will
  - Learn how to make C++ manipulate the data that we stored
  - Look at examples of simple arithmetic operators

C++ Statements

- There are two main types of C++ statements
  - Declaration statements
    - We looked at these last time. They are used to determine what data needs to be stored
  - Executable statements
    - Assignment statements
    - Input/Output operations
    - Arithmetic statements
- Today we will investigate assignment and I/O statements.

Assignment Statements

- Assign values to variables
  - Variables must have been declared
- Assignment operator is =
- The left operand must be a variable
- The right operand is an expression, where an expression can be a variable, constant, value, or complex expression using arithmetic operators
- The left operand gets the value of right operand

Assignments

- Examples
  ```cpp
  int num1 = 4;
  int num2, sum;
  num2 = 5;
  num1 = num2;
  sum = num1 + num2;
  ```

Input/Output Operations

- Output operations allow you to write information to a computer screen
- Input operations allow you to read information in from keyboard
- Other possible sources of I/O: files, printers, etc
- Stream: output and input is accomplished by using streams of characters
- Must have:
  - #include <iostream>
  - using namespace std;
Output

- Output operator (insertion operator): `<<`
- Standard output (monitor screen): `cout`
- The value to the right of the operator (right operand) is displayed on the screen
  - If the right operand is within double quotes, then it is output exactly as it appears
  - The exception is if it is an escape character `\`
  - If the right operand is a variable or constant, then the value of that variable or constant is output

What is the output?

```
cout << "Enter the distance in miles" << endl;
cout << "The distance in kilometers is " << kms << endl;
```

- You must always use the insertion operator `<<` to separate the different components you wish to output
- `endl` will move the cursor to a new line
- All output statements must end in a semicolon
- Output strings within double quotes "" should always appear on one line

Escape Characters

- These are special characters that can be output
- They are always preceded by a backslash `\`
- Examples of escape characters include:
  - `\n`: moves the cursor to the beginning of the next line
  - Equivalent to `endl`
  - `\r`: moves the cursor to the beginning of the current line
  - `\t`: moves the cursor to the next tab stop
  - `\": displays the backslash
  - `\"`: outputs the double quotes

Examples

- What is the output?
  - `cout << "This is a C++ program\n";`
  - `cout << "This is a \nC++ program";`
  - `cout << "\"This is a C++ program\"";`
  - `cout << "This is a\tC++\tprogram";`

Input

- Input operator (extraction operator): `>>`
- Gets input from some device/file
- Standard input (from keyboard): `cin`
- Whatever the user types in is stored in the variable to the right of the operator (the right operand)
- That variable must have already been declared
  - Given a data type and allocated space in memory
- When reading in the data typed by the user
  - Any spaces before the data item are skipped
  - Continues to read until the user hits return

Examples:

```
cin >> miles;
```

- The variable `miles` must have already been declared
- `int num1;`
- `int num2;`
- `cin >> num1 >> num2;`
Problem

- Write the C++ statements necessary to perform the following operations:
  - Display the message below onto the screen
    "C++ is a useful language to know"
  - Read in from the user their initials (assume there are only two) and their age

What is the Output?

```cpp
cout << "Enter two numbers: ";
cin >> a >> b;
a = a + 5.0;
b = 3.0 * b;
cout << "a = " << a << endl;
cout << "b = " << b << endl;
```

- Assume 5.0 and 7.0 are entered for a & b

What is the Output?

```cpp
· Assume x = 2, y = 3
  cout << x;
cout << x + x;
cout << "x=
";
cout << x + y << " = " << y + x;
z = x + y;
cin >> x >> y;
// cout << "x + y = " << x + y;
cout << ";n";
```

Program

- Write a program that reads in last week’s and this week’s gas prices and prints out the difference

Problem

- Write the complete program that calculates the area of a circle based on the radius input by the user
Summary

• In today’s lecture we learned
  o How to assign values to variables using the assignment operator
  o How to output strings and variables to the screen
  o How to read in input entered by the user using the keyboard
• We have covered p. 26 - 31 of your textbook