Chapter 2
Introduction to C++

- Reading: Chapter 2 (2.4 to 2.10), Chapter 3 (3.1)
- Good Problems to Work: pp. 40 [2.5], pp.47 [2.7, 2.8], pp.53 [2.11, 2.12, 2.15]
Variables

- Named storage location for holding data
  - named piece of memory
- You need to determine what variables you need in your program
  - what data do we need to handle?

```
int number;
```

- Tells the compiler
  - the variable's type (int)
  - the variable's name (number)

`int` is short for integer

- Variable definitions end with a semicolon
- Every variable must be defined
C++ Assignment Statement

- `=` is an operator that copies the value from the right into a variable on the left
- The item to the left of the `=` operator must be a variable
- You cannot write `5 = number;`

Variables in a program

```cpp
// This program has a variable called number
#include <iostream>
#include <string>
using namespace std;

int main() // what is the output of this program?
{
    int number;

    number = 5;
    cout << "Number is " << number << endl;
    number = 7;
    cout << "Now number is " << number << endl;

    return EXIT_SUCCESS;
}
```
cin object

- cin is an executable statement
- cin is the standard input object
- The keyboard is the standard input device
- cin is a stream object and works with streams of data
- The executable statement
  cin >> number;
  places the value a user types at the keyboard into the variable number?

 cin object

- Input operator (extraction operator): >>
- Standard input (from keyboard): cin
- Whatever the user types in is stored in the variable to the right of the operator (the right operand)
  - All variables must be previously declared
- When reading in the data typed by the user
  - Any spaces before the data item are skipped
  - Reading continues until the user hits return
What is the output?

Consider the following program:

```cpp
int num1;
int num2;

cout << "Enter two numbers: ";
cin >> num1 >> num2;

cout << num1 << " " << num2 << endl;
```

What is output if the user enters: 10 12
What is the output if the user enters: 5 10 15

Variable Definition

We now know that:

```cpp
int number;
```

What is an identifier?!
Identifiers (Variables)

- Programmer-defined names that represent some element of a program

- C++ limits on variable names:
  1. Identifiers must begin with a letter or an underscore
  2. Identifiers must consist of letters, numbers and underscore, nothing else
  3. Identifiers cannot be a keyword

Identifiers (Variables)

- Identifiers are case sensitive
  ```cpp
  int totalCost;
  int TotalCost;
  ```

- Use meaningful variable names
  ```cpp
  int width;
  int w;
  ```
Data types

- A data type defines:
  - how the computer interprets data in memory
- C++ has many data types including:
  - Numerical data: `int`, `double`, `float`
  - Textual data: `string`
  - Character data: `char`
  - Binary data: `bool`

Integer (**int**)  

- The main integer data type is `int`
  - Others are `short` and `long`
- `ints` are finite (why?)
  
  - An `int` without a sign (+ or -) is assumed to be positive
  - 2,353 is not an `int` while 2353 is an `int`
- Operations?
Character (char)

- The char data type is used to store a single character (a letter, a digit, or a special character).
  - ASCII is the internal representation for a char.
- Character literals are enclosed in single quotes.

Program

```cpp
#include <iostream>

using namespace std;

int main()
{
    char letter;

    letter = 'A';
    cout << letter << ' ';
    letter = 'B';
    cout << letter << endl;
    return EXIT_SUCCESS;
}
```
string Class

- string is used to store a list of characters
- Need to include the preprocessor directive
  ```
  #include <string>
  ```
  why?

string Questions

- How do we declare a variable of type string?
- How do we assign a value to the variable?
- How do we output a string literal and a string variable?
- What is the difference between ‘A’ and “A”?
Floating-Point (**double**) 

- **double, float, long double**
  - positive and negative
  - no unsigned float!
- Scientific Notation
- Examples:
  - 1.0, -2.3, -0.3, 12E5, -1E-2, 1.4e+8
- 2,353.99 is not a **double**
- 2353.99 is a **double**

Examples

- Remember, the format for declaring variables is:
  - **data-type** identifier;
- You can declare variables of the different data types as follows
  ```
  int num1;
  double num2;
  char letter;
  string name;
  ```
Boolean (bool)

- Variables of type `bool` can be either `true` or `false`
  - They cannot be any other value
  - For coding standards, we precede boolean variables with a `b`
- Example

```cpp
bool bValue;
bValue = true;
cout << bValue << endl;
bValue = false;
cout << bValue << endl;
```

Identifier Problem

- Which of the following declarations are invalid and why?
  1. `char Letter1;`
  2. `char 1letter;`
  3. `double inches, kms;`
  4. `double inches*num;`
  5. `int joe's;`
  6. `Int cent_per_inch;`
  7. `double two-dimensional;`
  8. `char hello;`
  9. `int return;`
  10. `size int;`