PFI lecture VARIABLE

- The concept of variable in programming
  - A location in memory for storing information
  - It has a name
  - It has two values: the information stored and memory location
  - It has a type
    - For whole number or integer: int
    - For “real number” (its approximate called “floating point”): double
    - For charater: char
    - For string of characters (e.g. statement in English): string
    - For decision making (as in if statement or loop): bool
  - It must be declared or introduced first to be able to use it
  - Programmers decide what variables to use and their names, types
  - It has a scope and storage class (for now without these concepts we may still comprehend the c++ code), will discuss them later.

Why does a variable need a name?

To identify or differentiate memory locations

Therefore, we cannot declare the same variable name more than once in the same scope of the program. Also keywords of the language such as if, int, etc. cannot be used as names.

Why does a variable need a type?

Type specifies the size of memory and how to interpret the binary value (0 and 1 pattern)

For example, 01000001 binary value, is ‘A’ for char type, true for bool type, and 65 for int type.

How do we declare a variable?

- Of type int
  - int amount;
  - int n;
- Of type double
  - double gpa;
  - double x;
- Of type string
  - string name;
- Of type char;
  - char letter;
- Of type bool
  - bool done;

How do we change (or set) the value of a variable?

- Note that even if the variable is not initialized, it still has a value. We simply do not know what it is.
- initialization
  - int amount = 100;
- assignment
  - amount = 2004;
- cin (the user provides)
  - cin >> amount;
- expression
  - amount++; // as an example

How do we “see” the value of a variable?

- In debugging and in figuring out what is going on with our program, we often need to know what are the values in our variables.
- cout (the user provides)
  - cout << “The value of amount at this line is ” << amount;
- Use debugger tool, which we will not cover in the class since cout is sufficient for our task.
- We may use a file (e.g., cout to a file)

How do we represent the value of a variable (literal) in our code?

- Of type int
  - 100 or -7 or 2016
- Of type double
  - 3.14 or 3.1415962 or -0.001
- Of type string
  - “Hello, World!” (note double quote)
- Of type char;
  - ‘A’ or ‘a’ (note single quote)
- Of type bool
  - true or false;

Basic arithmetic operators

- For integer type (integral values)
  - Addition: +
  - Subtraction: -
  - Multiplication: *
  - Division: /
  - Modular: %
- For double type (floating point values)
  - Addition: +
  - Subtraction: -
  - Multiplication: *
  - Division: /

Assignment statement

- General form: variable_name = expression;
- With literal: amount = 100;
- With expression (amount and n are variables):
  - amount = amount + amount;
  - amount = n;
  - n = n*n/amount;
  - amount = 3.14*n*n;
  - amount = (amount+n)/2;