Lecture – 3
Programming Fundamentals

Contents

- How C++ program works *(LL04)*
- Variables in C++ *(LL 04)*
- Variable declaration in C++ *(LL 04)*
- Variable definition in C++ *(LL 04)*
- Constants in C++ *(LL 04)*
- Variable as memory locations (LL 04)
- Inputting with *cin* statement (LL 02)
- Problem Examples (LL 04)
- Comments *(LL 02)*
- Types of comments *(LL 02)*
  - Single-Line comment *(LL 02)*
  - Multi-Line comment *(LL 02)*
- Comments example *(LL 02)*

LL 02 = Learning Level 02 – Comprehension, LL 04 = Learning Level 04 – Analysis

How C++ program works?

How C++ program works?

- First you will write source code in any of the text editor or IDE (e.g. Code:: Blocks, Dev C++)
- After that all the preprocessor directives will be executed by the preprocessor (e.g. #include, #define)
- Then the compiler will compile the source code and will generate object code that will be stored in the file with extension **.obj** or **.o**
- The linker then links all the object files with the static libraries. It can also link multiple object files with each other as well and produce one executable file.

How C++ program works?

- Then the loader loads the executable file in to the memory and makes it ready to be executed.
- Finally the CPU executes all the instruction of the program loaded in to the memory.
- Once program is executed, you will input the data and program gives you the desired output.

Data Types in C++

Data Type	Memory	Range Start	Range End
char	1 Byte	-128	127
unsigned char	1 Byte	0	255
short	2 Bytes	-32,768	32,767
unsigned short	2 Bytes	0	65,535
int	4 Bytes	-2,147,483,648	2,147,483,647
unsigned int	4 Bytes	0	4,294,967,295
long	8 Bytes	-9,223,372,036,854,775,807	9,223,372,036,854,775,807
unsigned long	8 Bytes	0	18,446,744,073,709,551,615
float	4 Bytes	3.4×10^{-38}	3.4×10^{38}
double	8 Bytes	1.7×10^{-308}	1.7×10^{308}
bool	1 Byte	true and false	

Variables in C++

- Variables are used to stored the data temporarily.
- A variable is a named piece of memory location.
- A single variable can store single value at a time.
- The value of the variable is changeable.

In order to create a variable we need to specify three things:

Name

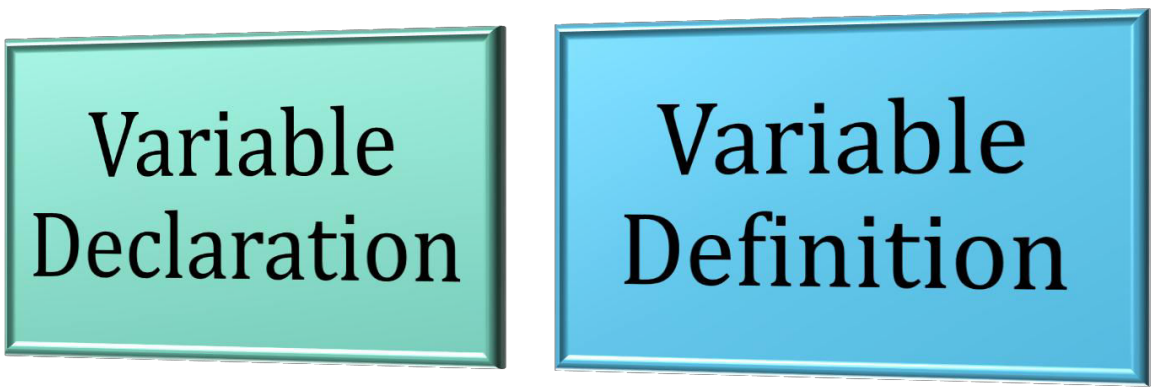
Data Type Value (optional)

Variables in C++

- The name of the variable is called as the **identifier**.
- The data type of the variable specifies the type of the value which will be stored in it.
- The value is the actual content which will be stored in it. It is optional because some time we know the exact value which will be stored, sometimes we do not know.

Creating Variables in C++

- There are two ways to create a variable:



Variable Declaration in C++

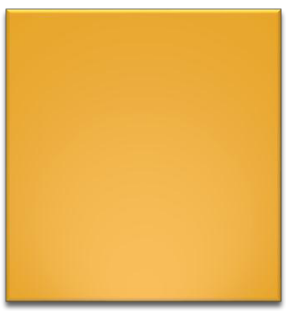
- A variable is declared when we do not know the value to be stored in it.
- To declare the variable, we need to specify two things: **name** and **data type**.

```
data_type    variable_name;
```

Variable Declaration in C++

```
float radius;
```

radius



Variable Declaration in C++

```
charv1 ;
unsigned   charv2 ;
short    v3 ;
unsigned   short v4 ;
int v5 ;
unsigned   int v6 ;
long   v7 ;
unsigned   longv8 ;
float   v9 ;
double v10 ;
boolv11 ;
```

Variable Definition in C++

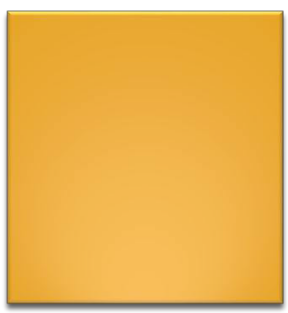
- A variable is defined when we know the exact value to be stored in it.
- To define the variable, we need to specify three things: **name**, **data type** and
value.

```
data_type    variable_name  =value;
```

Variable Definition in C++

```
float  radius = 56.214F;
```

radius 56.214



Constants in C++

- A constant is a variable whose value can not be altered during the execution of the
program.
- A constant is given a single value at the time of creation and it will hold that value till the entire execution of the program.
- In C++, a variable is declared as constant by just prefixing the variable definition statement with the keyword const.

```
const data_type    variable_name = constant_value; const

float   PI  = 3.1415F ;

const int MAX  = 100 ;
```

Inputting with cin

cin >> radius;

V4

200FH

2010H

2011H

Inputting with cin

- In C++, cin statement is used to get input from the keyboard.
- Cin is the Standard Console Input, which is the keyboard.
- Cin is used in conjunction with the **extraction operator** (**>>**).
- Anything inputted from keyboard will go to the variable to the right side of
  >> extraction operator.

Program Examples

Variables and constants in C++

Program Example 01

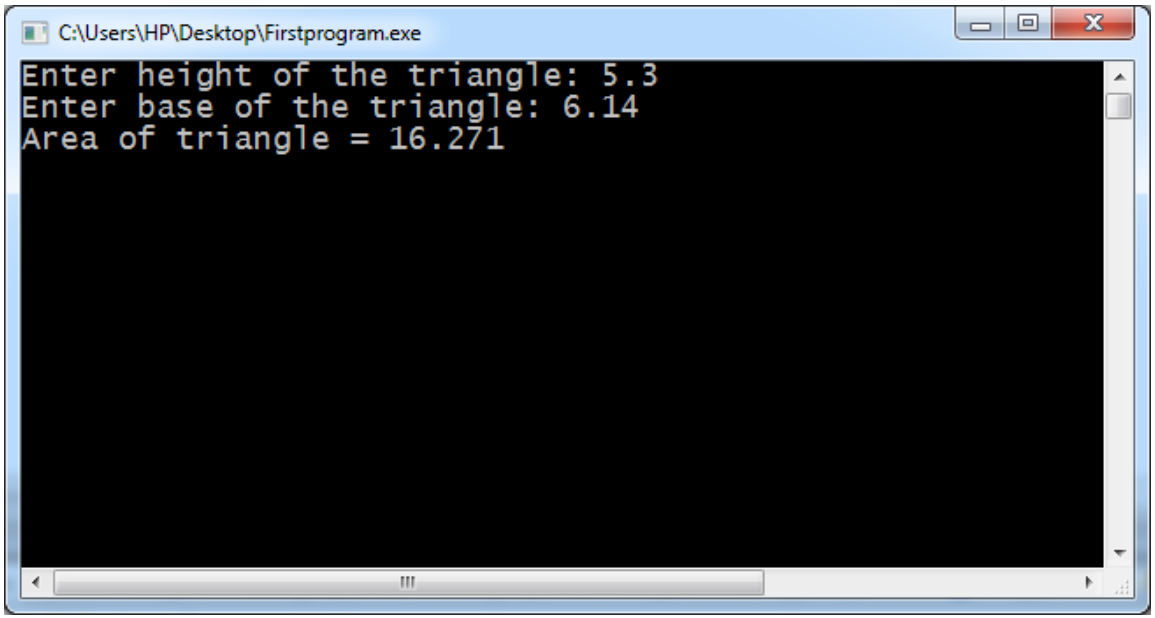
Problem Statement:

Write a computer program in C++ that accepts the base and height of a right angle triangle from the user and displays the area of the triangle.

Program Example 01

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    float height, base, area;

    cout<<"Enter height of the triangle: ";
    cin>>height;

    cout<<"Enter base of the triangle: ";
    cin>>base;

    area = (base * height) / 2;

    cout<<"Area of triangle = "<<area;

    getch();
    return 0;
}
```

Program Example 01



Program Example 02

Problem Statement:

A person is running in a circular ground. Write a program in C++ that asks the user to input the radius of the ground in meters and the number of rounds the person completes. The program should display the amount of distance travelled by the person in meters.

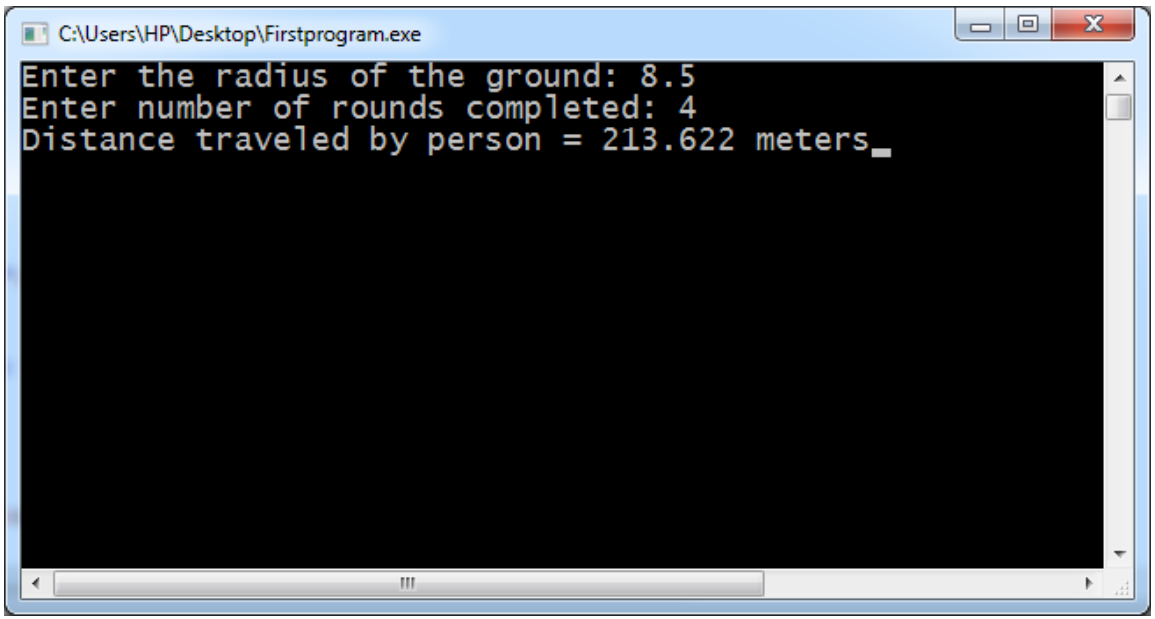
Program Example 02

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    const float PI = 3.1415F;
    float radius, distance;
    int rounds;

    cout<<"Enter the radius of the ground: ";
    cin>>radius;

    cout<<"Enter number of rounds completed: ";
    cin>>rounds;
```

Program Example 02

```
    distance = 2 * PI * radius * rounds;

    cout<<"Distance traveled by person = "<<distance<<" meters";

    getch();
    return 0;
}
```

Program Example 02



Program Example 03

Problem Statement:

Write a program in C++ that asks the user to enter two integer numbers, stores them in variables num1 and num2 respectively. The program swaps the values of two variables with each other without using a third variable and displays the values of both the variables after swapping.

Sample output:

Input:	Output:
num1 = 45	num1 = 94
num2 = 94	num2 = 45

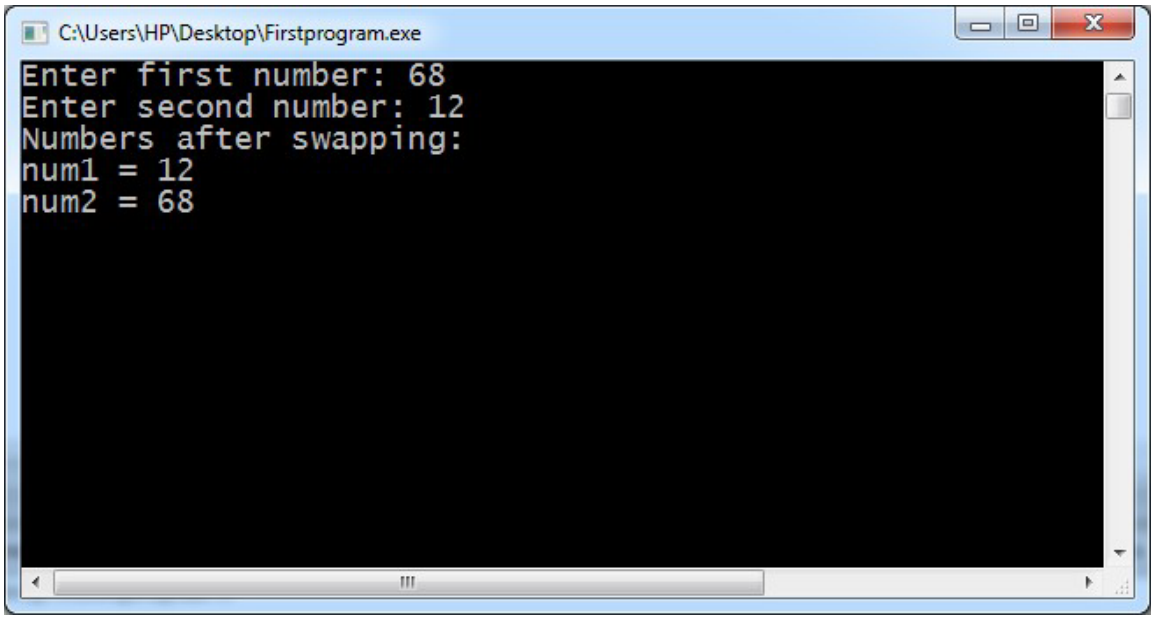
Program Example 02

```
#include<iostream>
#include<conio.h>

using namespace std;

int main()
{
    int num1, num2;

    cout<<"Enter first number: ";
    cin>>num1;

    cout<<"Enter second number: ";
    cin>>num2;

    num1 = num1 + num2;
    num2 = num1 - num2;
    num1 = num1 - num2;
```

Program Example 03

```
    cout<<"Numbers after swapping:\n";
    cout<<"num1 = "<<num1<<endl;
    cout<<"num2 = "<<num2<<endl;

    getch();
    return 0;
}
```

Program Example 03



Comments

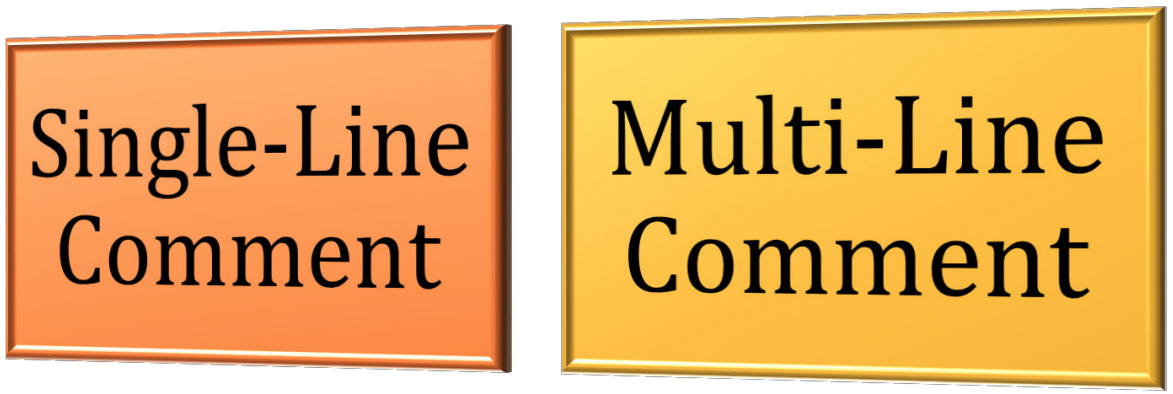
- Comment is the text that is used to explain the code inside the program.
- A comment is a line (or multiple lines) of text that are inserted into the source code

to explain what the code is doing.

- The programmer writes the comments in the program to make is easier to read for other persons (who want to read it).
- The comments are always ignored (not executed) by the compiler.
- The comments are non-executable statements in the program.
- Compiler does not consider comments as part of the program.
- Comments are also helpful during debugging the program.

Types of Comments

- There are two types of comments in C++



Single-Line Comment

- Single-Line comment, comments out entire line of the code.
- It starts with double slash // .
- Any text written after // is ignored by the compiler and is considered as the comment.

For Example:

```
getch(); //gets single character from the keyboard
```

Multi-Line Comment

- Multi-Line comment, comments out multiple lines of the code.
- It starts with slash asterisk **/*** .
- It ends with asterisk slash ***/**.
- Any text written in between **/*** and ***/** is ignored by the compiler and is considered as the comment.

For Example:

```
/*This  program  displays  string   on  screen

It iswritten by Miss Shumail
 It   isa basic
                        C++   program  */
```