

## 2. DATA HANDLING

In any language, there are some fundamentals you need to know before you can write even the most elementary programs. This chapter introduces the data types. C++ provides a predefined set of data types for handling the data it uses. The data types can either be fundamental or derived. The derived data types in C++ come in two groups: built-in types and user-defined types. Data can be stored in any of these data types.

### Learning Objectives

To Learn about:

- Data type and its type.
- Fundamental data type.
- Datatype Modifier
- Variable and its Scope.

### DATA TYPE

Data types are means to identify the type of data and associated operations of handling it. C++ data types are of two types:

(i) Fundamental types (ii) Derived types.

### FUNDAMENTAL DATA TYPES

Fundamental data types are those that are not composed of other data types.

Type	Keyword
Boolean	bool
Character	char
Integer	int
Floating point	float
Double floating point	double
Valueless	void

#### bool datatype

Boolean data type is used for storing boolean or logical values. A boolean variable can store either *true* or *false*. Keyword used for boolean data type is **bool**.

#### int datatype

Keyword used for integer data types is **int**. Integers typically requires 4 bytes of memory space and ranges from -2147483648 to 2147483647.

#### char data type

Character data type is used for storing characters. Keyword used for character data type is **char**. Characters typically requires 1 byte of memory space and ranges from -128 to 127 or 0 to 255.

### float data type

Floating Point data type is used for storing single precision floating point values or decimal values. Keyword used for floating point data type is **float**. Float variables typically requires 4 byte of memory space.

### double data type

Double Floating Point data type is used for storing double precision floating point values or decimal values. Keyword used for double floating point data type is **double**. Double variables typically requires 8 byte of memory space.

### void data type

Void means without any value. void datatype represents a valueless entity. Void data type is used for those function which does not returns a value.

## DATA TYPE MODIFIER

As the name implies, datatype modifiers are used with the built-in data types to modify the length of data that a particular data type can hold. Data type modifiers available in C++ are:

- **Signed**
- **Unsigned**
- **Short**
- **Long**

Below table summarizes the modified size and range of built-in datatypes when combined with the type modifiers:

DATA TYPE	SIZE (IN BYTES)	RANGE
short int	2	-32,768 to 32,767
unsigned short int	2	0 to 65,535
unsigned int	4	0 to 4,294,967,295
int	4	-2,147,483,648 to 2,147,483,647
long int	4	-2,147,483,648 to 2,147,483,647
unsigned long int	4	0 to 4,294,967,295

long long int	8	$-(2^{63})$ to $(2^{63})-1$
unsigned long long int	8	0 to 18,446,744,073,709,551,615
signed char	1	-128 to 127
unsigned char	1	0 to 255
float	4	
double	8	
long double	12	

## VARIABLES

A variable provides us with named storage that our programs can manipulate. Each variable in C++ has a specific type, which determines the size and layout of the variable's memory; the range of values that can be stored within that memory; and the set of operations that can be applied to the variable.

The name of a variable can be composed of letters, digits, and the underscore character. It must begin with either a letter or an underscore. Upper and lowercase letters are distinct because C++ is case-sensitive –

There are following basic types of variable in C++

Sr.No	Type & Description
1	<b>bool</b> Stores either value true or false.
2	<b>char</b> Typically a single octet (one byte). This is an integer type.
3	<b>int</b> The most natural size of integer for the machine.
4	<b>float</b> A single-precision floating point value.
5	<b>double</b> A double-precision floating point value.
6	<b>void</b> Represents the absence of type.

## VARIABLES DEFINITION

A variable definition tells the compiler where and how much storage to create for the variable. A variable definition specifies a data type, and contains a list of one or more variables of that type as follows –

```
type variable_list;
```

Here, **type** must be a valid C++ data type including char, int, float, double, bool or any user-defined object, etc., and **variable\_list** may consist of one or more identifier names separated by commas. Some valid declarations are shown here –

```
int i, j, k;
char c, ch;
float f, salary;
double d;
```

The line **int i, j, k;** both declares and defines the variables i, j and k; which instructs the compiler to create variables named i, j and k of type int.

Variables can be initialized (assigned an initial value) in their declaration. The initializer consists of an equal sign followed by a constant expression as follows –

```
type variable_name = value;
```

eg: int i=10, j=12;

## VARIABLES DECLARATION

A variable declaration provides assurance to the compiler that there is one variable existing with the given type and name so that compiler proceed for further compilation without needing complete detail about the variable. A variable declaration has its meaning at the time of compilation only, compiler needs actual variable definition at the time of linking of the program.

A variable declaration is useful when you are using multiple files and you define your variable in one of the files which will be available at the time of linking of the program. You will use **extern** keyword to declare a variable at any place. Though you can declare a variable multiple times in your C++ program, but it can be defined only once in a file, a function or a block of code.

### Example,

```
#include <iostream>
using namespace std;

// Variable declaration:
extern int a, b;
extern int c;
extern float f;

int main () {
    // Variable definition:
    int a, b;
    int c;
    float f;

    // actual initialization
    a = 10;
    b = 20;
    c = a + b;

    cout << c << endl ;

    f = 70.0/3.0;
    cout << f << endl ;

    return 0;
}
```

## Output:

```
30  
23.3333
```

## LVALUES AND RVALUES

There are two kinds of expressions in C++ –

- **lvalue** – Expressions that refer to a memory location is called "lvalue" expression. An lvalue may appear as either the left-hand or right-hand side of an assignment.
- **rvalue** – The term rvalue refers to a data value that is stored at some address in memory. An rvalue is an expression that cannot have a value assigned to it which means an rvalue may appear on the right- but not left-hand side of an assignment.

## SCOPE OF VARIABLE

A scope is a region of the program and broadly speaking there are three places, where variables can be declared –

- Inside a function or a block which is called local variables,
- In the definition of function parameters which is called formal parameters.
- Outside of all functions which is called global variables.

### Local Variables

Variables that are declared inside a function or block are local variables. They can be used only by statements that are inside that function or block of code.

### Global Variables

Global variables are defined outside of all the functions, usually on top of the program. The global variables will hold their value throughout the life-time of your program.

A global variable can be accessed by any function. That is, a global variable is available for use throughout your entire program after its declaration.

### Example

```

#include <iostream>
using namespace std;

// Global variable declaration:
int g;

int main () {
    // Local variable declaration:
    int a, b;

    // actual initialization
    a = 10;
    b = 20;
    g = a + b;

    cout << g;

    return 0;
}

```



## KEY POINTS

- Data types are means to identify the type of data and associated operations of handling it.
- C++ data types are of two types: (i) Fundamental types (ii) Derived types.
- Datatype modifiers are used with the built-in data types to modify the length of data that a particular data type can hold.
- A variable provides us with named storage that our programs can manipulate.
- The name of a variable can be composed of letters, digits, and the underscore character.
- Variables that are declared inside a function or block are local variables.
- Global variables are defined outside of all the functions, usually on top of the program.

## ASSESSMENT TIME

### I. Answer the following questions.

1. What are data types?
2. Write the types of data type.
3. What are data type modifier?
4. What is a variable? How many values are associated with it?
5. Explain fundamental data types.

### II. Find out the errors in the following.

1. 

```
int main()
{
    cout<< " Enter two numbers";
    cin>>num>>auto;
    float area= length * breadth;
}
```

## ACTIVITY TIME

1. Write a short program that asks for your height in centimetres and then converts your height to feet and inches. (1 foot = 12 inches, 1 inch = 2.54 cm)
2. Write a program to compute the area of a square.
3. Write a program to find area of a triangle.
4. Write a program to read two numbers and print their quotient and remainder.
5. Write a program to compute simple interest and compound interest.



