SNS COLLEGE OF TECHNOLOGY

Coimbatore – 35
An Autonomous Institution

PROBLEM SOLVING AND C PROGRAMMING

I YEAR – I SEM

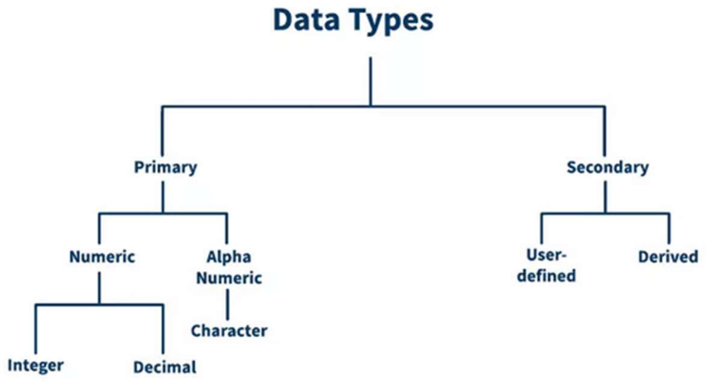
UNIT – II C PROGRAMMING BASICS

TOPIC - DATA TYPES

- Data type is an attribute of data which tells the compiler, which type of data a variable is holding.
- It can be of type integer, float (decimal), character , Boolean(true/false) etc.
- Formally we use data types to specify the type of data our variables are holding.
- Broadly there are two types of data types in C:

  a. Primary Data types

  b. Secondary Data Types



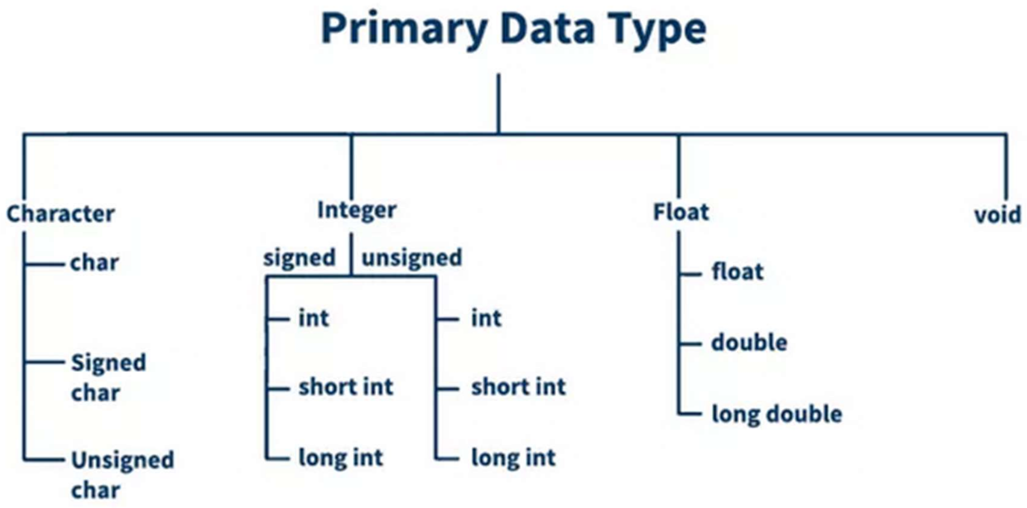
PRIMARY DATA TYPES OR BASIC DATA TYPES

These are the most basic data types and all the other data typed are derived or made from them only. It contains integer, floating point and char.

Four main types of primary/basic data types are:

1. Integer
2. Float
3. Char
4. Void

Now, these are further classified as short, long, double, long double, signed and unsigned data types in C.



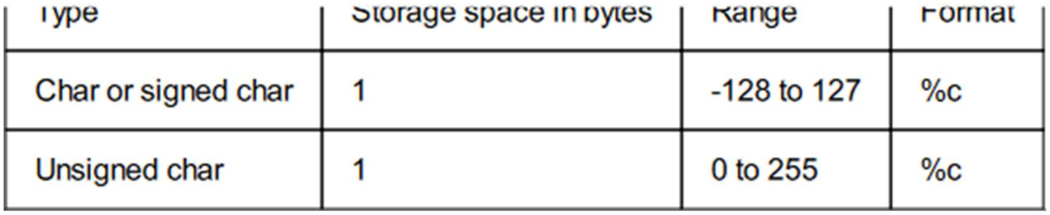
CHAR DATA TYPE

It is used to store a single character and requires 1 byte. A character could be any alphabet, number or special character written inside a pair of single inverted commas, eg ‘1’, ‘a’, ‘#’ etc.

Since it requires 1 Byte, which is 8 bits, the number of characters in C language is 256(2^8). Memory space differs with use of prefixes.

Eg:

```
#include <stdio.h>

void main() {                                       Output: a

   char c;

   c = 'a' ;

   printf("%c",c);

}
```



Type	Storage space in bytes	Range	Format
Char or signed char	1	-128 to 127	%c
Unsigned char	1	0 to 255	%c

INT DATA TYPE

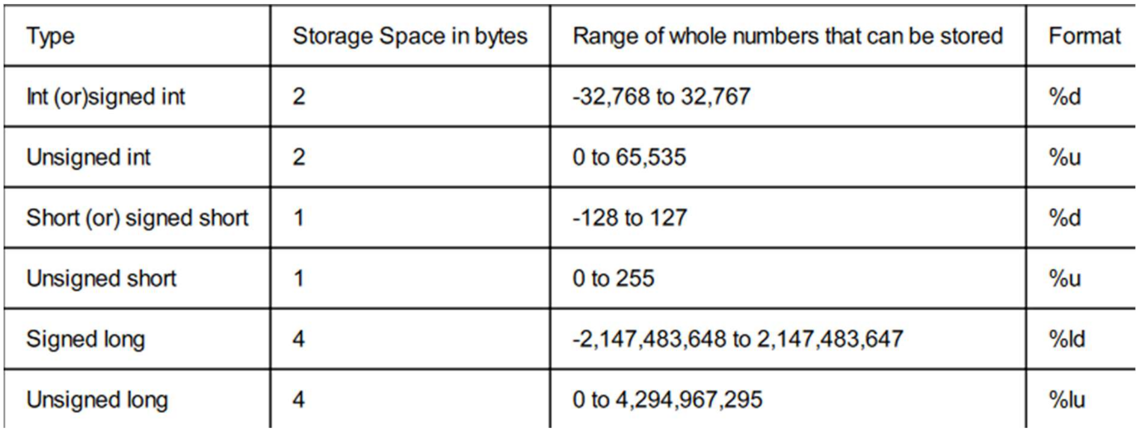
An integer type variable can store zero, positive, and negative values without any decimal. In C language, the integer data type is represented by the ‘int’ keyword, and it can be both signed or unsigned. By default, the value assigned to an integer variable is considered positive if it is unsigned.

The integer data type is further divided into short, int, and long data types. The short data type takes 2 bytes of storage space; int takes 2 or 4 bytes, and long takes 8 bytes in 64-bit and 4 bytes in the 32-bit OS.

If you try to assign a decimal value to the integer variable, the value after the decimal will be truncated, and only the whole number gets assigned to the variable.

Eg:

```
#include <stdio.h>

void main() {

   int i;

   i = 10;                                      output: 10

   printf("%d",i);

}
```



Type	Storage Space in bytes	Range of whole numbers that can be stored	Format
Int (or)signed int	2	-32,768 to 32,767	%d
Unsigned int	2	0 to 65,535	%u
Short (or) signed short	1	-128 to 127	%d
Unsigned short	1	0 to 255	%u
Signed long	4	-2,147,483,648 to 2,147,483,647	%ld
Unsigned long	4	0 to 4,294,967,295	%lu

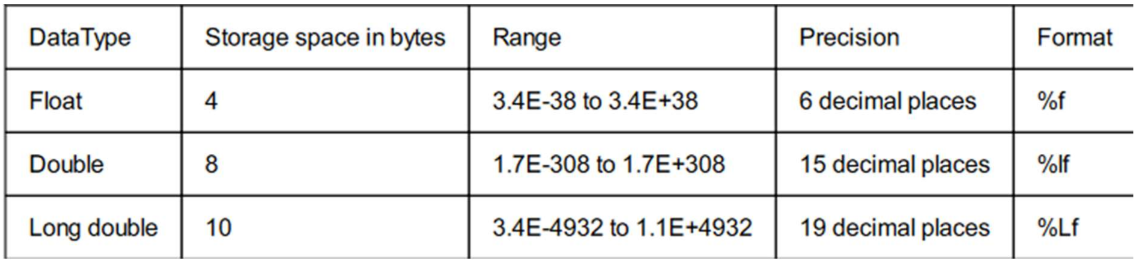
FLOAT

Floating point numbers are used to store decimal numbers. The range of values it can store also varies from compiler to compiler.

For 32-bit and 64-bit compilers, it is the same as 4 bytes. That is 2^(4*8) length of value, which is 4,29,49,67,296 i.e. 0 to 4,29,49,67,296 numbers can be represented using float.

Eg:

```
 #include <stdio.h>

void main() {

   float f;

   f = 1.20 ;                                         Output: 1.2000

   printf("%f",f);
}
```



DataType	Storage space in bytes	Range	Precision	Format
Float	4	3.4E-38 to 3.4E+38	6 decimal places	%f
Double	8	1.7E-308 to 1.7E+308	15 decimal places	%lf
Long double	10	3.4E-4932 to 1.1E+4932	19 decimal places	%Lf

VOID

It is a special type known as empty data type that is used to state that a given variable does not have any type. This is mainly used in defining functions where we do not want to return any value.

Basically void data type are used in some special places and some of them are following :
To specify return type of a function(when function returns no value).
To specify the parameters of a function(when the function accepts no argument from the caller)
To create generic pointers.

SECONDARY DATA TYPES

Secondary Data types are formed by combining two or more primary data types in C.

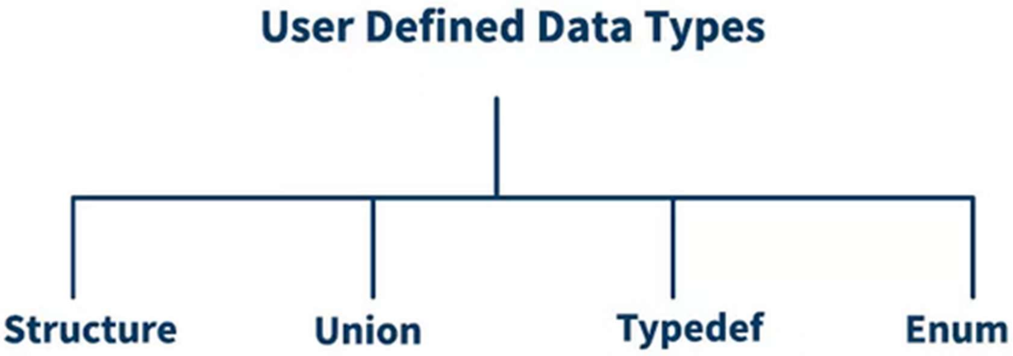
They are mainly of two types:

USER DEFINED DATA TYPES

DERIVED DATA TYPES

USER-DEFINED DATA TYPES IN C

These data types are defined by the user as per their convenience. If a user feels a need of having a data type which is not predefined in C library, then they make their own.



STRUCTURE

Structure is a user-defined data type in C, where we can store values of multiple data types.

UNION

Union is quite similar to structure as it is also used to store values of multiple data types. The only difference between structure and union is that, in union the space allocation is equal to the highest memory required by the data type.

TYPEDEF

It is a keyword present in C, which is used to give a new name to any data type.

For example, sometimes typing whole data type name can be tiring, now you can give a short name using typedef i.e, if you want to write unsigned long int in short form as INT, then you can use typedef as:

```
typedef unsigned long int ul;

ul i1, i2;
```

ENUM

Enum is a user-defined data type, which is used to make a program more readable and understandable. It is used to assign text values to integer values.

It basically uses an indexing method and assigns text values to the concerned index value.

Syntax: enum variablename {value1,value 2......};

Example:

```
enumweek{Sunday,Monday,Tuesday,wednesday,Thursday,Friday,Saturday};
enum colors{red,blue,green};
```

DERIVED DATA TYPES

Derived data types are data types which are formed by combining one or more primitive data types or basic data types in C. For example, there might be some cases where primitive data types are not sufficient for us. Like if we want to store a phone number we can use an integer but what if we want to store phone numbers of all the students in a college. Making variables for each of them is not the optimal way.

To deal with such situations optimally, C has some derived data types, which we can use as per our convenience.

1. ARRAY
2. STRING
3. POINTER
4. FUNCTIONS

ARRAY

Array is a derived data type which is used to store the data of the same type in a contiguous memory location. We can store any type of data types ranging from int , float, double, char to pointer, string, and structure. That is we can make an array of primitive, user-defined or of derived data types.

Array provides random access that is, we can get the value of any element in the array using its index value.

STRING

String is an array of characters. The difference between a normal character array and a string is that string contains ‘\0’ value at the end, indicating that this is the end of the string, while a simple character array does not need to have this.

‘\0’ is a special character, which is known as the NULL character and it is used to indicate the termination of a string.

There are many ways to initialise the string in C.

POINTER

Pointer is a special type of data type. They are special because unlike other data types it does not store normal values in variables. Each memory block in our computer’s memory has some specific address (exactly like a house address in a society). These pointer variables store addresses of any such memory location. Now pointers are also a type of variable, therefore it also needs some memory location and a memory space to store values.

FUNCTIONS

Functions in C or in any programming language refers to a set of instructions that, when executed in a given order, performs a specific task. The task could be like, finding maximum element, sorting the elements, reversing the elements etc.