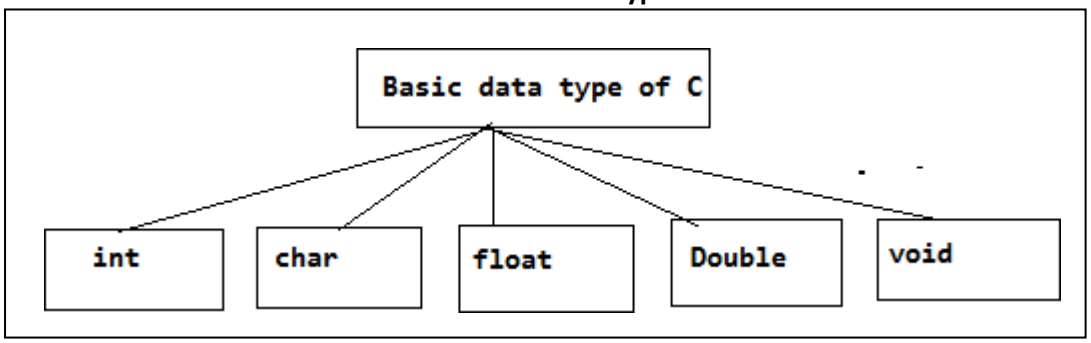
DATA TYPES IN C

→The data type, of a variable determines a set of values that a variable might take and a set of operations that can be applied to those values.

→Data type refer to the type and size of data associated with the variable and functions.

→Data types can be broadly classified as shown in Figure

Basic data type of C



	Data Type	Size in Bytes	Range	Format-Specifier
int	int	2	-32768 to +32767	%d
	short signed int (or) signed int	2	32768 to +32767	%d
	short unsigned int (or) unsigned int	2	0 to 65535	%u
	long signed int (or) long int	4	-2147483648 to 2147483647	%ld
	long unsigned int	4	0 to 4294967295	%lu
char	char or signed char	1	-128 to 127	%c
	unsigned char	1	0 to 255	%c
	float Allows 6 digits after decimal point.	4	$-3.4e^{-38}$ to $+3.4e^{38}$	%f
	double Allows 15 digits after decimal point.	8	$-1.7e^{-308}$ to $+1.7e^{308}$	%lf
	long double Allows 15 digits after decimal point.	10	$-1.7e^{-4932}$ to $1.7e^{4932}$	%LF

/*Program*/

```
#include<stdio.h>
int main()
{
char a;
unsigned char b;
int i;
unsigned int j;
long int k;
unsigned long int m;
float x;
double y
long double z;

printf("\n char and unsigned char");
scanf("%c %c",&a,&b) //get char and unsigned char value
printf("%c %c",a,b)  //display  char and unsigned char value

printf("\n int unsigned int");
scanf("%d %u",&i,&j) //get int unsigned int value
printf("%d %u",i,j)  //display int unsigned int value


printf("\n long int unsigned long int");
scanf("%ld %lu",&i,&j)  //get long int and long unsigned int value
printf("%ld %lu",i,j)  //display int unsigned int value

printf("\n float,double and long double");
scanf("%f %lf %Lf",&i,&j) //get float,double and long double value
printf("%f %lf %Lf",i,j)  //display float,double and long double value

return 0;
}
```

The specifiers and qualifiers for the data types can be broadly classified into three types

- ***Size specifiers***— short and long
- ***Sign specifiers***— signed and unsigned
- ***Type qualifiers***— const, volatile and restrict.

Size qualifiers alter the size of the basic data types. There are two such qualifiers that can be used with the data type int; these are short and long.

short, when placed in front of the data type int declaration, tells the C compiler that the particular variable being declared is used to store fairly small integer values. **Long** specifies it is a very big integer value.Long integers require twice the memory of than small ints.

Table: Sizes (bytes) of short int ,int,long int

	16-bit Machine (size in bytes)	**16-bit Machine (size in bytes)**	**16-bit Machine (size in bytes)**
short int	2	2	2
int	2	4	4
long int	4	4	8

Table:Size and range of *long long* type (64-bit machine)

Data type	**Size (in bytes)**	**Range**
long long int	8	-9, 223, 372, 036, 854, 775, 808 to +9, 223, 372, 036, 854, 775, 808
unsigned long int or unsigned long	4	0 to + 4, 294, 967, 295
unsigned long long int or unsigned long long	8	0 to + 18, 446, 744, 073,709, 551, 615

Sign specifiers: for example fot int data type out of 2bytes(2*8=16bits) of its size the highest bit(the sixtheenth bit) is used to store the sign of the integer value. The bit is 1 if number is negative and 0 if the number is positive.

Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12	Bit 13	Bit 14	Bit 15	Bit 16
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sign of number (1 for –ve and 0 for +ve0

Type qualifiers : There are two type qualifiers, const and volatile;

Eg: **const float pi = 3.14156;** // specifies that the variable pi can never be changed by the Program.

Table:Size and range in (16-bit machines)

Data type	Size (in bits) note:[1byte=8bits]	Range
char	8	–128 to 127
int	16	–32768 to 32767
float	32	1.17549×10^{-38} to 3.40282×10^{38}
double	64	2.22507×10^{-308} to 1.79769×10^{308}
Void	8	valueless

Table:Size and range of (32-bit machine)

Data type	Size (in bits) note:[1byte=8bits]	Range
char	8	–128 to 127
int	32	–2147483648 to 2147483647
float	32	1.17549×10^{-38} to 3.40282×10^{38}
double	64	2.22507×10^{-308} to 1.79769×10^{308}
Void	8	valueless

Allowed combinations of basic data types and modifi ers in C for a 16-bitcomputer

Data Type	Size (bits)	Range
char	8	–128 to 127
unsigned char	8	0 to 255
signed char	8	–128 to 127
int	16	–32768 to 32767
unsigned int	16	0 to 65535
signed int	16	–32768 to 32767
short int	16	–32768 to 32767
unsigned short int	16	0 to 65535
signed short int	16	–32768 to 32767
long int	32	–2147483648 to 2147483647
unsigned long int	32	0 to 4294967295
signed long int	32	–2147483648 to 2147483647
float	32	3.4E–38 to 3.4E+38
double	64	1.7E–308 to 1.7E+308
long double	80	3.4E–4932 to 1.1E+4932