

Data Types in C

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Each variable in C has an associated data type. It specifies the type of data that the variable can store like integer, character, floating, double, etc.

Example:

```
int number;
```

The above statement declares a variable with name **number** that can store **integer** values.

C is a statically type language where each variable's type must be specified at the declaration and once specified, it cannot be changed. This is because each data type requires different amounts of memory and allows type specific operations.

The data types in C can be classified as follows:

Types	Description	Data Types
Primitive Data Types	Primitive data types are the most basic data types that are used for representing simple values.	int, char, float, double, void
<u>Derived Types</u>	The data types that are derived from the primitive or built-in datatypes are referred to as Derived Data Types.	array, pointers, function

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Got It !

In this article, we will discuss the basic (primary) data types in C.

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Integer Data Type

The integer datatype in C is used to store the integer numbers (any number including positive, negative and zero without decimal part).

Octal values, hexadecimal values, and decimal values can also be stored in int data type in C.

- **Range:** -2,147,483,648 to 2,147,483,647
- **Size:** 4 bytes
- **Format Specifier:** %d

Format specifiers are the symbols that are used for printing and scanning values of given data types.

Example:

We use **[int keyword](#)** to declare the integer variable:

```
int val;
```

We can store the integer values (literals) in this variable.

```
1  #include <stdio.h>
2
3  int main() {
4      int var = 22;
5
6      printf("var = %d", var);
7      return 0;
8  }
```

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The integer data type can also be used as:

1. **unsigned int:** It can store the data values from zero to positive numbers, but it can't store negative values
2. **short int:** It is lesser in size than the int by 2 bytes so can only store values from -32,768 to 32,767.
3. **long int:** Larger version of the int datatype so can store values greater than int.
4. **unsigned short int:** Similar in relationship with short int as unsigned int with int.

***Note:** The size of an integer data type is compiler dependent. We can use [sizeof operator](#) to check the actual size of any data type. In this article, we are discussing the sizes according to 64-bit compilers.*

Character Data Type

Character data type allows its variable to store only a single character. The size of the character is **1 byte**. It is the most basic data type in C. It stores a single character and requires a single byte of memory in almost all compilers.

- **Range:** (-128 to 127) or (0 to 255)
- **Size:** 1 byte
- **Format Specifier:** %c

Example:

```
1  #include <stdio.h>
2
3  int main() {
4      char ch = 'A';
5
6      printf("ch = %c", ch);
7      return 0;
8  }
```

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In C programming, [float data type](#) is used to store single precision floating-point values. These values are decimal and exponential numbers.

- **Range:** 1.2E-38 to 3.4E+38
- **Size:** 4 bytes
- **Format Specifier:** %f

Example:

```
1  #include <stdio.h>
2
3  int main() {
4      float val = 12.45;
5
6      printf("val = %f", val);
7      return 0;
8  }
```

Double Data Type

The [double data type](#) in C is used to store decimal numbers (numbers with floating point values) with double precision. It can easily accommodate about 16 to 17 digits after or before a decimal point.

- **Range:** 1.7E-308 to 1.7E+308
- **Size:** 8 bytes
- **Format Specifier:** %lf

Example:

```
#include <stdio.h>

int main() {
    double val = 1.4521;

    printf("val = %d", val);
    return 0;
}
```

Void Data Type

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[pointers](#) and [function return type and parameters](#).

Example:

```
void fun(int a, int b){  
    // function body  
}
```

where function **fun** is a void type of function means it doesn't return any value.

Size of Data Types in C

The size of the data types in C is dependent on the size of the architecture, so we cannot define the universal size of the data types. For that, the C language provides the **sizeof()** operator to check the size of the data types.

Example

```
1  #include <stdio.h>  
2  
3  int main(){  
4  
5      // Use sizeof() to know size  
6      // the data types  
7      printf("The size of int: %d\n",  
8          sizeof(int));  
9      printf("The size of char: %d\n",  
10         sizeof(char));  
11     printf("The size of float: %d\n",  
12         sizeof(float));  
13     printf("The size of double: %d",  
14         sizeof(double));  
15  
16     return 0;  
17 }
```

Output

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The size of float: 4

The size of double: 8

Different data types also have different ranges up to which can vary from compiler to compiler. Below is a list of ranges along with the memory requirement and format specifiers on the **64-bit GCC compiler**.

Data Type	Size (bytes)	Range	Format Specifier
short int	2	-32,768 to 32,767	%hd
unsigned short int	2	0 to 65,535	%hu
unsigned int	4	0 to 4,294,967,295	%u
int	4	-2,147,483,648 to 2,147,483,647	%d
long int	4	-2,147,483,648 to 2,147,483,647	%ld
unsigned long int	4	0 to 4,294,967,295	%lu
long long int	8	$-(2^{63})$ to $(2^{63})-1$	%lld
unsigned long long int	8	0 to 18,446,744,073,709,551,615	%llu
signed char	1	-128 to 127	%c

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Data Type	Size (bytes)	Range	Format Specifier
float	4	1.2E-38 to 3.4E+38	%f
double	8	1.7E-308 to 1.7E+308	%lf
long double	16	3.4E-4932 to 1.1E+4932	%Lf

Note: The long, short, signed and unsigned are [datatype modifier](#) that can be used with some primitive data types to change the size or length of the datatype.

Literals in C

In C, [literals](#) are constant values assigned to variables. They represent fixed values that cannot be changed. Literals occupy memory but do not have references like variables. Often, the terms constants and literals are used interchangeably.

Type Conversion

In C, [type conversion](#) is the process of changing one data type into another. This can happen automatically by the compiler or manually by the programmer. Type conversion is only performed between data types where such a conversion is possible.

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[Literals in C](#)

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Data types in the C language can be categorized into three types, namely primitive, user-defined, and derived data types. In this article, we shall...

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Tokens in C

In C programming, tokens are the smallest units in a program that have meaningful representations. Tokens are the building blocks of a C...

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What is data type of FILE in C ?

Prerequisite : Basics of File Handling In C language, while file handling is done a word FILE is used. What is FILE? Example FILE *fp1, *fp2; While...

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C Compound Data Type Quizzes

In C, compound data types are those data types that are derived from basic data types. They provide an interface to use the basic data types is...

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Format Specifiers in C

The format specifier in C is used to tell the compiler about the type of data to be printed or scanned in input and output operations. They always sta...

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%d in C

The format specifiers in C are used in formatted strings to represent the type of data to be printed. Different data types have different format...

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Literals in C

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C fundamentals teach you how to store and access data in the program, input and output data, learn how to perform basic operations and control...

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C Pointers

A pointer is a variable that stores the memory address of another variable. Instead of holding a direct value, it has the address where the value is...

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Operators in C

In C language, operators are symbols that represent some kind of operations to be performed. They are the basic components of the C...

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