**UNIT 1 BASICS OF C PROGRAMMING 6**

Problem Solving Techniques: Introduction to Algorithm, Pseudo code, Flow Chart, Structure of 'C' program. C Tokens: Keywords, Data Types, Constants, Variables - Declaration - Qualifiers – typedef

## 1.4 KEYWORDS

Keywords are those predefined words that have special meaning in the compiler and they cannot be used for any other purpose. As per the C99 standard, C language has 32 keywords. Keywords cannot be used as identifiers.

- The following table has the list of all keywords (reserved words) available in the C language:

| | | | |
|---|---|---|---|
| Auto | double | int | struct |
| break | else | long | switch |
| Case | enum | register | typedef |
| char | extern | return | Union |
| continue | for | signed | Void |
| Do | if | static | While |

| | | | |
|---|---|---|---|
| default | goto | sizeof | volatile |
| const | float | short | unsigned |

All the keywords in C have lowercase alphabets, although the keywords that have been newly added in C, do have uppercase alphabets in them.

C is a case-sensitive language. Hence, int is a keyword but INT, or Int are not recognized as a keyword.

The compiler checks the source code for the correctness of the syntax of all the keywords and then translates it into the machine code.

These keywords can be broadly classified in following types −

- Primary Data types
- User defined types
- Storage types
- Conditionals
- Loops and loop controls
- Others

## **Primary Types C Keywords**

These keywords are used for variable declaration. C is a statically type language, the variable to be used must be declared. Variables in C are declared with the following keywords:

| | |
|---|---|
| int | Declares an integer variable |
| long | Declares a long integer variable |
| short | Declares a short integer variable |
| signed | Declares a signed variable |
| double | Declares a double-precision variable |
| char | Declares a character variable |
| float | Declares a floating-point variable |
| unsigned | Declares an unsigned variable |
| void | Specifies a void return type |

## **User-defined Types C Keywords**

C language allows you to define new data types as per requirement. The user defined type has one or more elements of primary type.

The following keywords are provided for user defined data types −

| | |
|---|---|
| struct | Declares a structure type |
| typedef | Creates a new data type |
| union | Declares a union type |
| enum | Declares an enumeration type |

## Storage Types C Keywords

The following set of keywords are called storage specifiers. They indicate the location where in the memory the variables stored. Default storage type of a variable is auto, although you can ask the compiler to form a variable with specific storage properties.

| | |
|---|---|
| auto | Specifies automatic storage class |
| extern | Declares a variable or function |
| static | Specifies static storage class |
| register | Specifies register storage class |

## Conditionals C Keywords

The following set of keywords help you to put conditional logic in the program. The conditional logic expressed with if and else keywords provides two alternative actions for a condition. For multi-way branching, use switch – case construct. In C, the jump operation in an assembler is implemented by the goto keyword.

| | |
|---|---|
| goto | Jumps to a labeled statement |
| if | Starts an if statement |
| else | Executes when the if condition is false |
| case | Labels a statement within a switch |
| switch | Starts a switch statement |
| default | Specifies default statement in switch |

## Loops and Loop Control C Keywords

Repetition or iteration is an essential aspect of the algorithm. C provides different alternatives for forming a loop, and keywords for controlling the behaviour of the loop. Each of the keywords let you form a loop of different characteristics and usage.

| | |
|---|---|
| For | Starts a for-loop |
| do | Starts a do-while loop |
| while | starts a while loop |
| continue | skips an iteration of a loop |
| break | Terminates a loop or switch statement |

**Other C Keywords**

The following miscellaneous keywords are also extremely important:

| | |
|---|---|
| const | Specifies a constant value |
| Sizeof | Determines the size of a data type |
| Volatile | compiler that the value of the variable may change at any time |

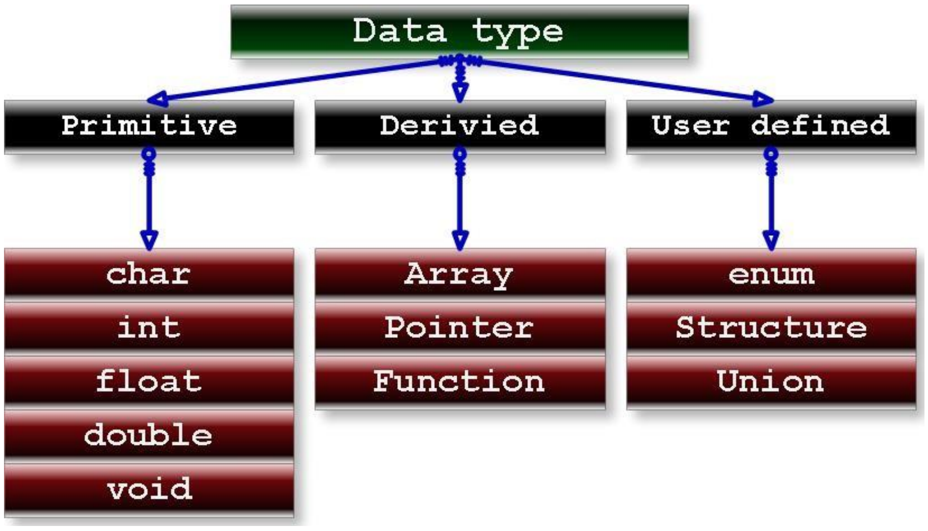
## 1.1 DATA TYPES IN C

- 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.
- Each data type requires different amounts of memory and has some specific operations which can be performed over it.

**The data types in C can be classified as follows:**

| **Types** | **Description** |
|---|---|
| **Primitive Data Types** | Primitive data types are the most basic data types that are used for representing simple values such as integers, float, characters, etc. |
| **User Defined Data Types** | The user-defined data types are defined by the user himself. |
| **Derived Types** | The data types that are derived from the primitive or built-in datatypes are referred to as Derived Data Types. |

The data type is a collection of data with values having fixed values, meaning as well as its characteristics.



Different data types also have different ranges up to which they can store numbers. These ranges may vary from compiler to compiler. Below is a list of ranges along with the memory requirement and format specifiers on the **32-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 |
| **unsigned char** | 1 | 0 to 255 | %c |
| **float** | 4 | 1.2E-38 to 3.4E+38 | %f |
| **double** | 8 | 1.7E-308 to 1.7E+308 | %lf |

## Primitive data types in C:

1. **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 be stored in int data type in C.

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

**Syntax**

**int** *var_name;*

**C program to print Integer data types.**

```
#include <stdio.h>
 int main()
{
   // Integer value with positive data.
```

```
    int a = 9;
     // integer value with negative data.
    int b = -9;
     // U or u is Used for Unsigned int in C.
    int c = 89U;
     // L or l is used for long int in C.
    long int d = 99998L;
     printf("Integer value with positive data: %d\n", a);
    printf("Integer value with negative data: %d\n", b);
    printf("Integer value with an unsigned int data: %u\n",c);
    printf("Integer value with an long int data: %ld", d);
    return 0;
}
```

**Output**

```
Integer value with positive data: 9

Integer value with negative data: -9

Integer value with an unsigned int data: 89

Integer value with a long int data: 99998
```

The integer data type can also be used as

1. **unsigned int:** Unsigned int data type in C is used to store the data values from zero to positive numbers but it can't store negative values like signed int.
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.

## 2. 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

**Syntax of char**

The **char keyword** is used to declare the variable of character type:

```
char var_name;
```

// **C program to print Integer data types.**

```
#include <stdio.h>
 int main()
{
char c = 'a';
printf("Value of c: %c\n", c);
  c++;
  printf("Value of a after increment is: %c\n", c);
  return 0;
}
```

**Output**

```
Value of c: a

Value of c after increment is: b
```

**3. Float Data Type**

In C programming float data type is used to store floating-point values. Float in C is used to store decimal and exponential values. It is used to store decimal numbers (numbers with floating point values) with single precision.

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

Syntax of float

The **float keyword** is used to declare the variable as a floating point:

```
float var_name;
```

```
// C Program to demonstrate use of Floating types
#include <stdio.h>
int main()
{
    float a = 9.0f;
    float b = 2.5f;
          // 2x10^-4
    float c = 2E-4f;
    printf("%f\n", a);
    printf("%f\n", b);
    printf("%f", c);

    return 0;
}
```

**Output**

```
9.000000

2.500000

0.000200
```

### 4. Double Data Type

A <u>Double data type</u> in C is used to store decimal numbers (numbers with floating point values) with double precision. It is used to define numeric values which hold numbers with decimal values in C.

The double data type is basically a precision sort of data type that is capable of holding 64 bits of decimal numbers or floating points.

Since double has more precision as compared to that float then it is much more obvious that it occupies twice the memory occupied by the floating-point type. 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

**Syntax of Double**

The variable can be declared as double precision floating point using the **double keyword:**

```
double var_name;
```

**// C Program to demonstrate use of double data type**

```
#include <stdio.h>
 int main()
{
    double a = 123123123.00;
    double b = 12.293123;
    double c = 2312312312.123123;
 printf("%lf\n", a);
 printf("%lf\n", b);
 printf("%lf", c);
 return 0;
}
```

## 5. Void Data Type

The void data type in C is used to specify that no value is present. It does not provide a result value to its caller.

It has no values and no operations. It is used to represent nothing. Void is used in multiple ways as function return type, function arguments as void, and pointers to void.

## 6. 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.

**Syntax:**

```
// function return type void
void exit(int check);
// Function without any parameter can accept void.
```

```
int print(void);
// memory allocation function which returns a pointer to void.
void *malloc (size_t size);
```

**// C Program to print size of different data type in C**

```
#include <stdio.h>
 int main()
{
    int size_of_int = sizeof(int);
    int size_of_char = sizeof(char);
    int size_of_float = sizeof(float);
    int size_of_double = sizeof(double);
    printf("The size of int data type : %d\n", size_of_int);
    printf("The size of char data type : %d\n",size_of_char);
    printf("The size of float data type : %d\n",size_of_float);
    printf("The size of double data type : %d",size_of_double);
    return 0;
}
```