

C Functions

Function is a group of statements that together perform a task. Every C program has at least one function, which is **main()**, and all the most trivial programs can define additional functions.

You can divide up your code into separate functions. How you divide up your code among different functions is up to you, but logically the division usually is so each function performs a specific task.

A function **declaration** tells the compiler about a function's name, return type, and parameters. A function **definition** provides the actual body of the function.

The C standard library provides numerous built-in functions that your program can call. For example, function **strcat()** to concatenate two strings, function **memcpy()** to copy one memory location to another location and many more functions.

A function is known with various names like a method or a sub-routine or a procedure, etc.

Defining a Function

The general form of a **function definition** in C programming language is as follows:

```
return_type function_name( parameter list )
{
    body of the function
}
```

A function definition in C programming language consists of a function header and a function body. Here are all the parts of a function:

- **Return Type:** A function may return a value. The **return_type** is the data type of the value the function returns. Some functions perform the desired operations without returning a value. In this case, the **return_type** is the keyword **void**.
- **Function Name:** This is the actual name of the function. The function name and the parameter list together constitute the function signature.
- **Parameters:** A parameter is like a placeholder. When a function is invoked, you pass a value to the parameter. This value is referred to as actual parameter or argument. The

- parameter list refers to the type, order, and number of the parameters of a function. Parameters are optional; that is, a function may contain no parameters.
- **Function Body:** The function body contains a collection of statements that define what the function does.

Example

Following is the source code for a function called max(). This function takes two parameters num1 and num2 and returns the maximum between the two:

```
/* function returning the max between two numbers */
int max(int num1, int num2)
{
    /* local variable declaration */
    int result;

    if (num1 > num2)
        result = num1;
    else
        result = num2;

    return result;
}
```

Function Declarations

A **function declaration** tells the compiler about a function name and how to call the function. The actual **body of the function** can be defined separately.

A function declaration has the following parts:

```
return_type function_name( parameter list );
```

For the above defined function max(), following is the function declaration:

```
int max(int num1, int num2);
```

Parameter names are not important in function declaration only their type is required, so following is also valid declaration:

```
int max(int, int);
```

Function declaration is required when you define a function in one source file and you call that function in another file. In such case you should declare the function at the top of the file calling the function.

Calling a Function

While creating a C function, you give a definition of what the function has to do. To use a function, you will have to call that function to perform the defined task.

When a program calls a function, program control is transferred to the called function. A called function performs defined task, and when its return statement is executed or when its function-ending closing brace is reached, it returns program control back to the main program.

To call a function, you simply need to pass the required parameters along with function name, and if function returns a value, then you can store returned value. For example:

```
#include <stdio.h>

/* function declaration */
int max(int num1, int num2);

int main ()
{
    /* local variable definition */
    int a = 100;
    int b = 200;
    int ret;

    /* calling a function to get max value */
    ret = max(a, b);

    printf( "Max value is : %d\n", ret );

    return 0;
}

/* function returning the max between two numbers */
int max(int num1, int num2)
{
    /* local variable declaration */
    int result;

    if (num1 > num2)
        result = num1;
    else
        result = num2;

    return result;
}
```

I kept max() function along with main() function and compiled the source code. While running final executable, it would produce the following result:

```
Max value is : 200
```

Function Arguments

If a function is to use arguments, it must declare variables that accept the values of the arguments. These variables are called the formal parameters of the function.

The formal parameters behave like other local variables inside the function and are created upon entry into the function and destroyed upon exit.

While calling a function, there are **two ways** that arguments can be passed to a function:

Function call by value

The **call by value** method of passing arguments to a function copies the actual value of an argument into the formal parameter of the function. In this case, changes made to the parameter inside the function have no effect on the argument.

By default, C programming language uses call by value method to pass arguments. In general, this means that code within a function cannot alter the arguments used to call the function. Consider the function swap() definition as follows.

```
/* function definition to swap the values */
void swap(int x, int y)
{
    int temp;

    temp = x; /* save the value of x */
    x = y;    /* put y into x */
    y = temp; /* put x into y */

    return;
}
```

Now, let us call the function swap() by passing actual values as in the following example:

```
#include <stdio.h>

/* function declaration */
void swap(int x, int y);

int main ()
{
    /* local variable definition */
    int a = 100;
    int b = 200;

    printf("Before swap, value of a : %d\n", a );
    printf("Before swap, value of b : %d\n", b );

    /* calling a function to swap the values */
    swap(a, b);

    printf("After swap, value of a : %d\n", a );
    printf("After swap, value of b : %d\n", b );

    return 0;
}
```

Let us put above code in a single C file, compile and execute it, it will produce the following result:

```
Before swap, value of a :100
Before swap, value of b :200
```

```
After swap, value of a :100
After swap, value of b :200
```

Which shows that there is no change in the values though they had been changed inside the function.

Function call by reference

The **call by reference** method of passing arguments to a function copies the address of an argument into the formal parameter. Inside the function, the address is used to access the actual argument used in the call. This means that changes made to the parameter affect the passed argument.

To pass the **value by reference**, argument pointers are passed to the functions just like any other value. So accordingly you need to declare the function parameters as pointer types as in the following function swap(), which exchanges the values of the two integer variables pointed to by its arguments.

```
/* function definition to swap the values */
void swap(int *x, int *y)
{
    int temp;
    temp = *x;    /* save the value at address x */
    *x = *y;      /* put y into x */
    *y = temp;    /* put x into y */

    return;
}
```

Let us call the function swap() by passing values by reference as in the following example:

```
#include <stdio.h>

/* function declaration */
void swap(int *x, int *y);

int main ()
{
    /* local variable definition */
    int a = 100;
    int b = 200;

    printf("Before swap, value of a : %d\n", a );
    printf("Before swap, value of b : %d\n", b );

    /* calling a function to swap the values.
     * &a indicates pointer to a ie. address of variable a and
     * &b indicates pointer to b ie. address of variable b.
     */
    swap(&a, &b);

    printf("After swap, value of a : %d\n", a );
    printf("After swap, value of b : %d\n", b );
}
```

```
    return 0;  
}
```

Let us put above code in a single C file, compile and execute it, it will produce the following result:

```
Before swap, value of a :100  
Before swap, value of b :200  
After swap, value of a :100  
After swap, value of b :200
```

Which shows that there is no change in the values though they had been changed inside the function.