UNIT III
STRINGS & FUNCTIONS

3.1.1 STRING DECLARATION AND INITIALIZATION

- ***String Declaration:***
  - String data type is not supported in C Programming. String means Collection of Characters to form particular word. String is useful whenever the name of the person, Address of the person, some descriptive information need to be given as input. String is not declared using String Data Type like other programming languages such as Java, instead array of type character is used to create String.
  - Character Array is Called as 'String'.
  - Character Array is Declared Before Using it in Program.

    char String_Variable_name [SIZE] ;

    e.g: char city[30];

Particulars	Explanation
Significance	- We have declared array of character[i.e String]
Size of string	- 30 Bytes
Bound checking	- C Does not Support Bound Checking i.e if we store City with size greater than 30 then C will not give you any error
Data type	- char
Maximum size	- 30

Precautions to be taken while declaring Character Variable :

- String / Character Array Variable name should be legal C Identifier.
- String Variable must have Size specified.
  - **char city[];**

  Above Statement will cause compile time error.
- Do not use String as data type because String data type is included in later languages such as C++ / Java. C does not support String data type
  - **String city;**

Initializing String [Character Array] :

- Whenever a String has been declared as array of characters, then it will contain garbage values inside it. Hence String has to be initialized or read value into the Character array before using it. Process of Assigning some legal default data to String is Called Initialization of String. There are different ways of initializing String in C Programming –
    1)Initializing Unsized Array of Character
    2)Initializing String Directly
    3)Initializing String Using Character Pointer

Way 1 : Unsized Array and Character

- ***Unsized Array*** : Array Length is not specified while initializing character array using this approach
- Array length is Automatically calculated by Compiler
- Individual Characters are written inside Single Quotes , Separated by comma to form a list of characters. Complete list is wrapped inside Pair of Curly braces.

- ***NULL Character(End of String Character)*** should be written in the list because it is ending or terminating character in the String/Character Array.
- char name [] = {'P','P','S','\0'};

Way 2 : Directly initialize String Variable

- In this method we are directly assigning String to variable by writing text in double quotes.
- In this type of initialization , we don’t need to put NULL or Ending / Terminating character at the end of string. It is appended automatically by the compiler.
- char name [ ] = "PPS";

Way 3 : Character Pointer Variable

- Declare Character variable of pointer type so that it can hold the base address of “String”
- Base address means address of first array element i.e (address of name[0])
- NULL Character is appended Automatically
- char *name = "PPS";

3.1.2 STRING FUNCTIONS

- gets()
- puts()
- Atoi()
- Strlen()
- Strcat ()
- Strcmp()
- Sprintf()
- Sscanf()
- Strrev()
- Strcpy()
- Strstr()
- strtok()

(i) GETS():

Syntax for Accepting String :

char * gets (char * str); OR gets(<variable-name>)

Example :

```
#include<stdio.h>
void main()
{
        char name[20];
        printf("\nEnter the Name : ");
 gets(name); }
```

Output:

Enter the name: programming in c

Explanation :

- Whenever gets() statement encounters then characters entered by user (the string with spaces) will be copied into the variable.
- If user start accepting characters , and if new line character appears then the newline character will not be copied into the string variable(i.e name).
- A terminating null character is automatically appended after the characters copied to string vriable (i.e name)
- gets() uses stdin (Standered Input Output) as source, but it does not include the ending newline character in the resulting string and does not allow to specify a maximum size for string variable (which can lead to buffer overflows).

Some Rules and Facts :

A. %s is not Required :

Like scanf statement %s is not necessary while accepting string.

scanf("%s",name);

and here is gets() syntax which is simpler than scanf() –

gets(name);

B. Spaces are allowed in gets() :

gets(name);

Whenever the above line encounters then interrupt will wait for user to enter some text on the screen. When user starts typing the characters then all characters will be copied to string and when user enters newline character then process of accepting string will be stopped.

Sample Input Accepted by Above Statement :

- Value Accepted : Problem solving\n
- Value Stored : Problem solving (\n Neglected)

2. PUTS():

Way 1 :Messaging

- puts(" Type your Message / Instruction ");
- Like Printf Statement puts() can be used to display message.

Way 2 : Display String

- puts(string_Variable_name) ;

Notes or Facts :

- puts is included in header file “stdio.h”
- As name suggest it used for Printing or Displaying Messages or Instructions.

Example :

```
#include<  stdio.h>
#include< conio.h>
void main()
 {
  char string[] = "This is an example string\n";
  puts(string);     // String is variable Here
  puts("String");   // String is in Double Quotes
  getch();
}
```

Output :

String is : This is an example string

String is : String

atoi FUNCTION:

- atoi = a to i = alphabet to integer
- **Convert String of number into Integer** **Syntax: num = atoi(String);**

num - Integer Variable

String- String of Numbers

Example :

```
char a[10] = "100";
int value = atoi(a);
printf("Value = %d\n", value);
```

Output :

Value : 100

Significance :

- Can Convert any String of Number into Integer Value that can Perform the arithmetic Operations like integer
- Header File : **stdlib.h**

Ways of Using atoi Function :

Way 1 : Passing Variable in Atoi Function

```
int num;
char marks[3] = "98";
num = atoi(marks);
printf("\nMarks : %d",num);
```

Way 2 : Passing Direct String in atoi Function

```
int num;
num = atoi("98");
printf("\nMarks : %d",num);
```

OTHER INBUILT TYPECAST FUNCTIONS IN C PROGRAMMING LANGUAGE:

- Typecasting functions in C language performs data type conversion from one type to another.
- Click on each function name below for description and example programs.

  - atof() Converts string to float
  - atoi() Converts string to int
  - atol() Converts string to long
  - itoa() Converts int to string
  - ltoa() Converts long to string

*STRLEN FUNCTION: -***Finding length of string**

Point		Explanation
No of Parameters	-	1
Parameter Taken	-	Character Array Or String
Return Type	-	Integer
Description	-	Compute the Length of the String
Header file	-	string.h

Different Ways of Using strlen() :

- There are different ways of using strlen function. We can pass different parameters to strlen() function.

Way 1 : Taking String Variable as Parameter

```
char str[20];
int length ;
printf("\nEnter the String : ");
gets(str);
length = strlen(str);
printf("\nLength of String : %d ", length);
```

Output:

Enter the String : hello

Length of String : 5

Way 2 : Taking String Variable which is Already Initialized using Pointer

```
char *str = "priteshtaral";
int length ;
length = strlen(str);
printf("\nLength of String : %d ", length);
```

Way 3 : Taking Direct String

```
int length ;
length = strlen("pritesh");
printf("\nLength of String : %d",length);
```

Way 4 : Writing Function in printf Statement

```
char *str = "pritesh";
printf("\nLength of String : %d", strlen(str));
```

3. STRCAT FUNCTION:

What strcat Actually does ?

- Function takes 2 Strings / Character Array as Parameter
- Appends second string at the end of First String. Parameter

Taken - 2 Character Arrays / Strings Return Type - Character Array / String

- **Syntax :char* strcat (char * s1, char * s2);**

Ways of Using Strcat Function :

Way 1 : Taking String Variable as Parameter

```
char str1[20] = “Don” , str2[20] = “Bosco”;
strcat(str1,str2);
puts(str1); // Output : DonBosco
```

Way 2 : Taking String Variable which is Already Initialized using Pointer

```
char *str1 = “Ind”,*str2 = “ia”;
strcat(str1,str2);// Result stored in str1
puts(str1);// Result:  India
```

Way 3 : Writing Function in printf Statement

```
printf(“nString:  %s“, strcat(“Ind”,”ia”));
```

4. STRCMP FUNCTION:

What strcmp Actually Does ?

- Function takes two Strings as parameter.
- It returns integer .
- Syntax :

```
int strcmp ( char *s1, char *s2 ) ;
```

Return Type		**Condition**
-ve Value	-	String1 < String2
+ve Value	-	String1 > String2
0 Value	-	String1 = String2

Example 1 : Two strings are Equal

```
char s1[10] = "SAM",s2[10]="SAM" ;
int len;
len = strcmp(s1,s2);
```

Output

0

*/*So the output will be 0. if u want to print the string then give condition like*/*

```
char s1[10] = "SAM",s2[10]="SAM" ;
int len;
len = strcmp(s1,s2);
if (len == 0)
        printf ("Two Strings are Equal");
```

Output:

Two Strings are Equal

Example 2 : String1 is Greater than String2

```
char s1[10] = "SAM",s2[10]="sam" ;
int len;
len = strcmp (s1,s2);
printf ("%d",len); //-ve value
```

Output:

-32

Reason :

ASCII value of “SAM” is smaller than “sam”

ASCII value of ‘S’ is smaller than ‘s’

Example 3 : String1 is Smaller than String1

```
char s1[10] = "sam",s2[10]="SAM" ;
int len;
len = strcmp (s1,s2);
printf ("%d",len); //+ve value
```

Output:

85

Reason :

ASCII value of “SAM” is greater than “sam”

ASCII value of ‘S’ is greater than ‘s’

1. *SPRINTF FUNCTION:*

- **sends formatted output to String**.

Features :

- Output is Written into String instead of Displaying it on the Output Devices.
- Return value is integer (i.e Number of characters actually placed in array / length of string).
- String is terminated by '\0'.
- Main Per pose : Sending Formatted output to String.
- Header File : **Stdio.h**
- **Syntax : int sprintf(char *buf,char format,arg_list);**

Example :

```
int age = 23 ;
char str[100];
sprintf( str , "My age is %d",age);
puts(str);
```

Output:

My age is 23

Analysis of Source Code: Just keep in mind that

- Assume that we are using printf then we get output “My age is 23”
- What does printf does ? —– Just Print the Result on the Screen
- Similarly Sprintf stores result “My age is 23” into string str instead of printing it.

3.11.2 SSCANF FUNCTION:

Syntax :

int sscanf(const char *buffer, const char *format[, address, ...]);

What it actually does ?

- Data is read from array Pointed to by buffer rather than stdin.
- Return Type is Integer
- Return value is nothing but number of fields that were actually assigned a value

Example

```
#include <stdio.h>
int main ()
{
   char buffer[30]="Fresh2refresh 5 ";  char
   name [20];
   int age;
   sscanf (buffer,"%s %d",name,&age);
   printf ("Name : %s \n Age : %d \n",name,age);
   return 0;
}
```

Output:

Name : Fresh2refresh

Age : 5

3. STRSTR FUNCTION:

- **Finds first occurrence of sub-string in other string**

Features :

- Finds the first occurrence of a sub string in another string
- Main Purpose : **Finding Substring**
- Header File : **String.h**
- Checks whether s2 is present in s1 or not
- On success, strstr returns a pointer to the element in s1 where s2 begins (points to s2 in s1).
- On error (if s2 does not occur in s1), strstr returns null.

Syntax : char *strstr(const char *s1, const char *s2);

```
#include <stdio.h>  #include
<string.h>  int main ()
{
  char string[55] ="This is a test string;  char *p;
  p = strstr (string,"test");  if(p)
  {
printf("string found\n");
```

```
printf("First string \"test\" in \"%s\" to   "\" \"%s \"" ,string, p);
  }
  else
            printf("string not found\n" );
   return 0;
}
```

Output:

string found

First string “test” in “This is a test string” to “test string”.

Example 2

Parameters as String initialized using Pointers

```
#include<stdio.h>
#include<string.h>
int main(void)
{
   char *str1 = "c4learn.blogspot.com", *str2 = "spot", *ptr;
   ptr = strstr(str1, str2);
   printf("The substring is: %sn", ptr);
   return 0;
}
```

Output :

The substring is: spot.com

Example 3
Passing Direct Strings

```
#include<stdio.h>
#include<string.h>
void main()
{
   char *ptr;
   ptr = strstr("c4learn.blogspot.com","spot");
   printf("The substring is: %sn", ptr);
}
```

Output :

The substring is: spot.com

3.11.4 STRREV():

- reverses a given string in C language. Syntax for strrev( ) function is given below.

char *strrev(char *string);

- strrev() function is nonstandard function which may not available in standard library in C.

Algorithm to Reverse String in C :

- Start
- Take 2 Subscript Variables ‘i’,’j’
- ‘j’ is Positioned on Last Character
- ‘i’ is positioned on first character
- str[i] is interchanged with str[j]
- Increment ‘i’
- Decrement ‘j’
- If ‘i’ > ‘j’ then goto step 3
- Stop

Example

```
#include<stdio.h>
#include<string.h>
int main()
{
   char name[30] = "Hello";
            printf("String before strrev() :%s\n",name);
            printf("String after strrev(%s", strrev(name));
            return 0;
}
```

Output:

```
String before strrev() : Hello
String after strrev()  : olleH
```

5. STRCPY FUNCTION:

Copy second string into First

What strcmp Actually Does ?

- Function takes two Strings as parameter.
- Header File : String.h.
- It returns string.
- Purpose : Copies String2 into String1.
- Original contents of String1 will be lost.
- Original contents of String2 will remains as it is.

Syntax :

char * strcpy (char *string1, char *string2) ;

- strcpy (str1, str2) – It copies contents of str2 into str1.
- strcpy (str2, str1) – It copies contents of str1 into str2.
- If destination string length is **less than source string**, **entire source string value won't be copied into destination** string.
- For example, consider destination string length is 20 and source string length is 30. Then, only 20 characters from source string will be copied into destination string and remaining 10 characters won't be copied and will be truncated.

Example 1

```
char s1[10] = "SAM" ;

char s2[10] = "MIKE" ;

strcpy (s1,s2);

puts (s1) ;      // Prints : MIKE

puts (s2) ;      // Prints : MIKE
```

Output:

MIKE

MIKE

Example 2

```
#include <stdio.h>
#include <string.h>
int main( )
{
  char source[ ] = "hihello" ;
  char target[20]= "" ;
  printf ( "\nsource string = %s", source ) ;
  printf ( "\ntarget string = %s", target ) ;
  strcpy ( target, source ) ;
 printf("target string after strcpy()=%s",target) ;
   return 0; }
```

Output

```
source string = hihello
target string =
target string after strcpy( ) = hihello
```

6. STRTOK FUNCTION

- **tokenizes/parses the given string using delimiter.**

Syntax

char * strtok (char * str, const char * delimiters);

For example, we have a comma separated list of items from a file and we want individual items in an array.

- *Splits str[] according to given delimiters and returns next token.*
- *It needs to be called in a loop to get all tokens.*
- *It returns NULL when there are no more tokens.*

Example

```
#include <stdio.h>
 #include <string.h>
int main()
{
        char str[] = "Problem_Solving_in_c";//Returns first token  char* token =
        strtok(str, "_");//Keep printing tokens while one of the delimiters present in
        str[].
        while (token != NULL) {
                printf("%s\n", token);
```

```
token = strtok(NULL, "_");
        }
```

Output:

Problem Solving in C

12. ARITHMETIC CHARACTERS ON STRING

- C Programming Allows you to Manipulate on String
- Whenever the Character is variable is used in the expression then it is automatically Converted into Integer Value called ASCII value.
  - All Characters can be Manipulated with that Integer Value.(Addition,Subtraction)

Examples :

ASCII value of : ‘a’ is 97

ASCII value of : ‘z’ is 121

Possible Ways of Manipulation :

Way 1:Displays ASCII value[Note that %d in Printf]

```
char x = 'a';

printf("%d",x); // Display Result = 97
```

Way 2 :Displays Character value[Note that %c in Printf]

```
char x = 'a';

printf("%c",x); // Display Result = a
```

Way 3 : Displays Next ASCII value[Note that %d in Printf]

```
char x = 'a' + 1 ;

printf("%d",x); //Display Result = 98 (ascii of 'b' )
```

Way 4 Displays Next Character value[Note that %c in Printf]

```
char x = 'a' + 1;
printf("%c",x); // Display Result = 'b‘
```

Way 5 : Displays Difference between 2 ASCII in Integer[Note %d in Printf]

```
char x = 'z' - 'a';
printf("%d",x);/*Display Result = 25 (difference between ASCII of z and a ) */
```

Way 6 : Displays Difference between 2 ASCII in Char [Note that %c in Printf]

```
char x = 'z' - 'a';
printf("%c",x);/*Display Result =( difference between ASCII of z and a ) */
```

13. FUNCTION DECLARATION AND DEFINITION:

- A 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 is such that 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, **strcat()** to concatenate two strings, **memcpy()** to copy one memory location to another location, and many more functions.
- A function can also be referred as a method or a sub-routine or a procedure, etc.

3.13.1 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 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

```
main()
{
        display();
}
void mumbai()
{
        printf("In mumbai");
}
void pune()
{
        india();
}
void display()
{
        pune();
}
void india()
{
        mumbai();
}
```

- We have written functions in the above specified sequence , however functions are called in which order we call them.

- Here **functions are called this sequence** –

- main()

display()
pune() india()
mumbai().

Why Funtion is used???

Advantages of Writing Function in C Programming

1. Modular and Structural Programming can be done

- ❑ We can divide c program in **smaller modules**.
- ❑ We can call module whenever require. e.g suppose we have written calculator program then we can write 4 modules (i.e add,sub,multiply,divide)
- ❑ Modular programming **makes C program more readable**.
- ❑ Modules once created , **can be re-used in other programs**.

2. It follows Top-Down Execution approach , So main can be kept very small.

- ❑ Every C program starts **from main function**.
- ❑ Every function is **called directly or indirectly through main**
- ❑ Example : **Top down approach**. (functions are executed from top to bottom)

3. Individual functions can be easily built,tested

- ❑ As we have developed C application in modules **we can test each and every module**.
- ❑ **Unit testing** is possible.
- ❑ Writing code in function will **enhance application development process**.

3. Program development become easy

4. Frequently used functions can be put together in the customized library

- ❑ We can put frequently used functions in **our custom header file**.
- ❑After creating header file we can re use header file. We can include header file in other program.

5. A function can call other functions & also itself

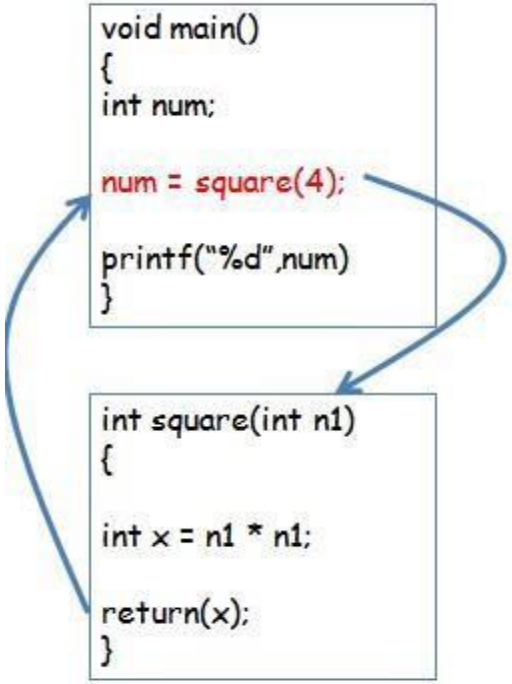
- ❑ Function can call other function.
- ❑ Function can call itself , which is called as “recursive” function.
- ❑ Recursive functions are also useful in order to write system functions.

6. It is easier to understand the Program topic

- ❑ We can get overall idea of the project just by reviewing function names.

How Function works in C Programming?

- C programming is modular programming language.
- We must divide C program in the different modules in order to create more readable, eye catching ,effective, optimized code.
- In this article we are going to see how function is C programming works ?



Explanation : How function works in C Programming ?

- Firstly Operating System will call our main function.
- When control comes inside main function , execution of main starts execution of C program starts) i.e
- Consider Line 4 :

  num = square(4);
- We have called a function square(4). [See : How to call a function ?].
- We have passed “4” as parameter to function.

Note : Calling a function halts execution of the current function , it will execute called function

- after execution control returned back to the calling function.
- Function will return 16 to the calling function.(i.e. main)
- Returned value will be copied into variable.
- printf will gets executed.
- main function ends.
- C program terminates.

FUNCTION PROTOTYPE DECLARATION IN C PROGRAMMING

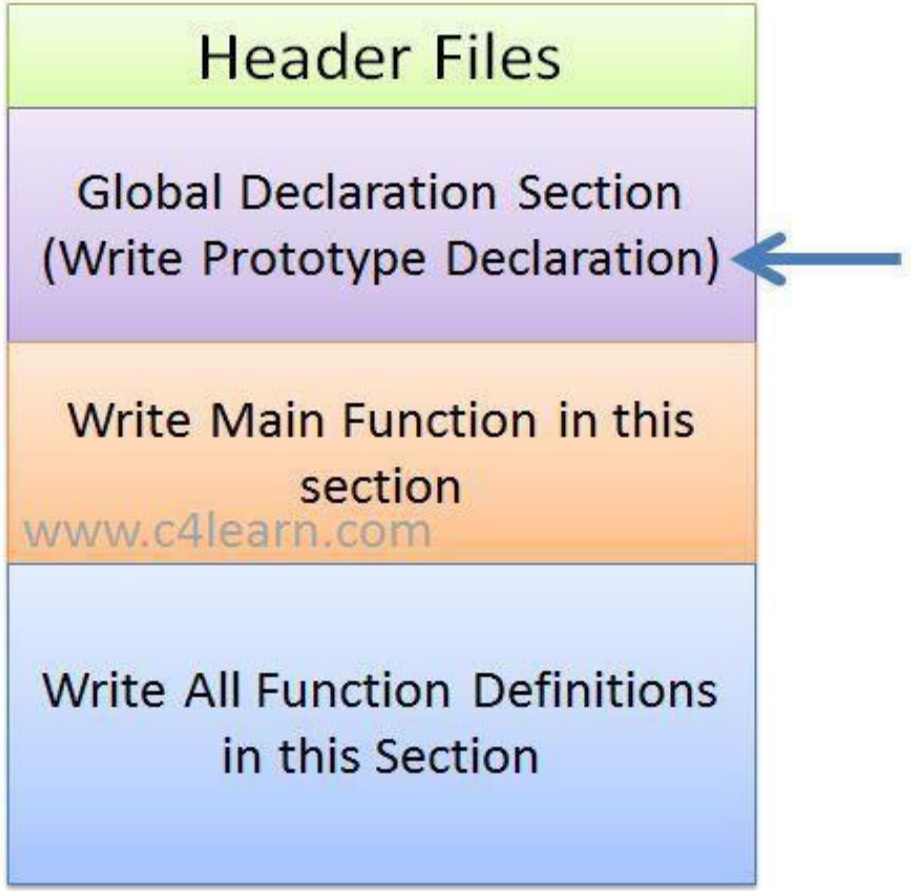
- Function prototype declaration is necessary in order to provide information the compiler about function, about return type, parameter list and function name etc.

Important Points :

- Our program starts from main function. Each and every function is called directly or indirectly through main function
- Like variable we also need to declare function before using it in program.
- In C, declaration of function is called as prototype declaration
- Function declaration is also called as function prototype

Points to remember

- Below are some of the important notable things related to prototype declaration –
- It tells name of function,return type of function and argument list related information to the compiler
- Prototype declaration always ends with semicolon.
- Parameter list is optional.
- Default return type is integer.


Header Files
Global Declaration Section
(Write Prototype Declaration)
Write Main Function in this section
www.c4learn.com
Write All Function Definitions in this Section

Syntax

return_type function_name (type arg1, type arg2.....);

prototype declaration comprised of three parts i.e name of the function,return type and parameter list

Examples of prototype declaration

- Function with two integer arguments and integer as return type is represented using syntax **int sum(int,int);**
- Function with integer argument and integer as return type is represented using syntax **int square(int);**
- In the below example we have written function with no argument and no return type **void display(void);**
- In below example we have delclared function with no argument and integer as return type **int getValue(void);**

Positioning function declaration

- If function definition is written after main then and then only we write prototype declaration in global declaration section
- If function definition is written above the main function then ,no need to write prototype declaration

Case 1 : Function definition written before main

```
#include<stdio.h>
void displayMessage()
{
printf(“welcome");
}
void main()
{
displayMessage();
}
```

Case 2 : Function definition written after main

```
#include<stdio.h> //Prototype Declaration  void
displayMessage();
void main()
{
     displayMessage();
}
void displayMessage()
{
    printf(“welcome");
}
```

Need of prototype declaration

- Program Execution always starts from main , but during lexical analysis (1st Phase of Compiler) token generation starts from left to right and from top to bottom.
- During code generation phase of compiler it may face issue of backward reference.

14. TYPES OF CALLING

- 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, the program control is transferred to the called function. A called function performs a defined task and when its return statement is executed or when its function-ending closing brace is reached, it returns the program control back to the main program.
- To call a function, you simply need to pass the required parameters along with the function name, and if the function returns a value, then you can store the 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; }
```

output

Max value is : 200

We have kept max() along with main() and compiled the source code. While running the final executable, it would produce the following result –
Max value is : 200

- 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.
- 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 in which arguments can be passed to a function –
- By default, C uses **call by value** to pass arguments. In general, it means the code within a function cannot alter the arguments used to call the function.

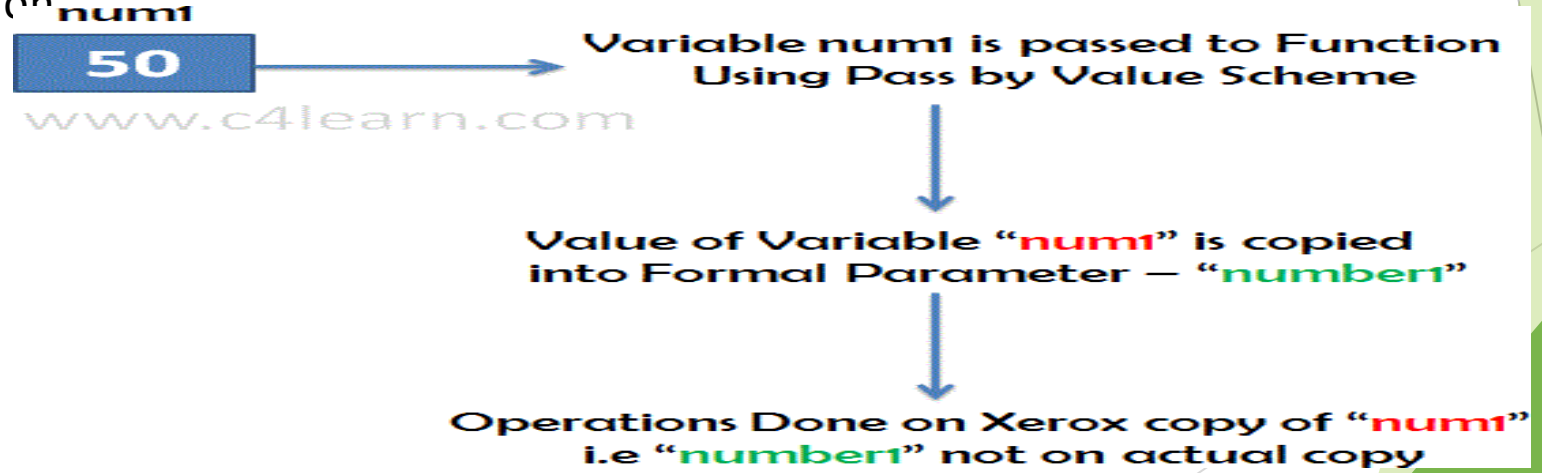
Sr.No.	Call Type & Description

1	**Call by value** This method 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.
	/* 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 temp into y */
	return; }

2	**Call by reference** This method 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 argument.
	/* function definition to swap the values */
	void swap (int *x, int *y)
	{
	int temp;
	temp = *x;
	*x = *y;
	*y = temp;
	return; }

1. CALL BY VALUE

- While Passing Parameters using call by value , xerox copy of original parameter is created and passed to the called function.
- Any update made inside method will not affect the original value of variable in calling function.
- In the above example num1 and num2 are the original values and xerox copy of these values is passed to the function and these values are copied into number1,number2 variable of sum function respectively.
- As their scope is limited to only function so they cannot alter the values inside main functio



```
#include <stdio.h>
void swap(int x, int y); /* function declaration */  int main ()
{
        int a = 100; /* local variable definition */
        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;
}
```

Output:

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

2. 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. It means the changes made to the parameter affect the passed argument.
- To pass a 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()**, exchanges the values of the two integer variables pointed to, by arguments.

```
#include <stdio.h>
void swap(int *x, int *y); /* function declaration */
 int main ()
{
        int a = 100; /* local variable definition */
        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;
}
```

output

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

15. .1 FUNCTION WITH ARGUMENTS AND NO RETURN VALUE :

- Function accepts argument but it does not return a value back to the calling Program .
- It is Single (One-way) Type Communication
- Generally Output is printed in the Called function
- **Function declaration :** void function();
- **Function call :** function();
- **Function definition :** void function() { statements; }

```
#include <stdio.h>
void checkPrimeAndDisplay(int n);
int main()
{
        int n;
        printf("Enter a positive integer: ");
        scanf("%d",&n);
        // n is passed to the function
         checkPrimeAndDisplay(n);
        return 0;
}
```

```
// void indicates that no value is returned from the function
void checkPrimeAndDisplay(int n)
{
        int i, flag = 0;
        for(i=2; i <= n/2; ++i)
        {
                if(n%i == 0)
                {
                  flag = 1;
                  break;
                }
        }
       if(flag == 1)
              printf("%d is not a prime number.",n);
       else
              printf("%d is a prime number.", n);
}
```

OUTPUT :Enter a positive integer : 4

4 is not a prime number

3.15.2 FUNCTION WITH NO ARGUMENTS AND NO RETURN VALUE IN C

When a function has no arguments, it does not receive any data from the calling function. Similarly when it does not return a value, the calling function does not receive any data from the called function.

Syntax :

Function declaration : void function();

Function call : function();

Function definition : void function()

{

statements;

}

```
#include<stdio.h>
void area(); // Prototype Declaration
void main()
{
    area();
}
```

```
void area()
{
    float area_circle;
    float rad;
     printf("\nEnter the radius : ");
    scanf("%f",&rad);
     area_circle = 3.14 * rad * rad ;
     printf("Area of Circle = %f",area_circle);
}
```

Output :

Enter the radius : 3

Area of Circle = 28.260000

3.16.1 FUNCTION WITHOUT ARGUMENTS AND RETURN VALUE

There could be occasions where we may need to design functions that may not take any arguments but returns a value to the calling function. A example for this is getchar function it has no parameters but it returns an integer an integer type data that represents a character.

Function declaration : int function();

Function call : function();

Function definition : int function() { statements; return x; }

```
#include<stdio.h>
 int sum();
 int main()
{
    int addition;
    addition = sum();
    printf("\nSum of two given values = %d", addition);
```

```
 return 0;
}

int sum()
{
   int a = 50, b = 80, sum;
   sum = a + b;
   return sum;
}
```

OUTPUT

Sum of two given values = 130

3.16.2 FUNCTION WITH ARGUMENTS AND RETURN VALUE

Syntax :

Function declaration : int function (int);

Function call : function(x);

Function definition: int function(int x) { statements; return x; }

```
#include<stdio.h>

float calculate_area(int);

int main()

 {

        int radius;

        float area;

        printf("\nEnter the radius of the circle : ");

        scanf("%d",&radius);

        area = calculate_area(radius);

        printf("\nArea of Circle : %f ",area);

        return 0;

}
```

```
float calculate_area(int radius)
{
        float areaOfCircle;
        areaOfCircle = 3.14 * radius * radius;
        return(areaOfCircle);
}
```

Output:

Enter the radius of the circle : 2

Area of Circle : 12.56

17. PASSING ARRAY TO FUNCTION IN C

Array Definition :

Array is collection of elements of similar data types .

Passing array to function :

Array can be passed to function by two ways :

- **Pass Entire array**
- **Pass Array element by element**

1 . Pass Entire array

- Here entire array can be passed as a argument to function .
- Function gets **complete access** to the original array .
- While passing entire array Address of first element is passed to function , any changes made inside function , directly **affects the Original value** .
- Function Passing method : **"Pass by Address"**

2 . Pass Array element by element:

- Here individual elements are passed to function as argument.
- Duplicate **carbon copy of Original variable** is passed to function .
- So any changes made inside function **does not affects the original value.**
- Function doesn't get complete access to the original array element.
- Function passing method is **"Pass by Value".**

Passing entire array to function :

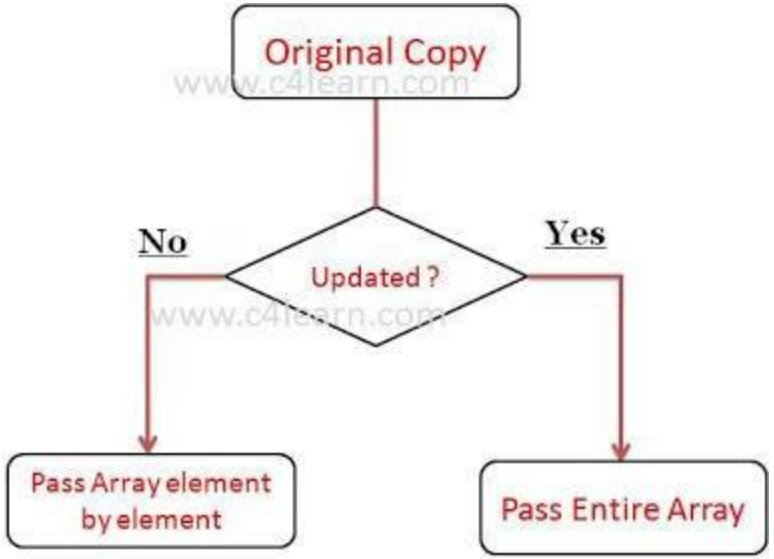
- Parameter Passing Scheme : **Pass by Reference**
- Pass name of array as function parameter .
- Name contains the base address i.e (Address of 0th element)
- Array values are updated in function .
- Values are reflected inside main function also.

```
#include<stdio.h>   #include<conio.h>   void
fun(int arr[])
{
        int i;
        for(i=0;i< 5;i++)
            arr[i] = arr[i] + 10;
}
void main()
{
        int arr[5],i;
        clrscr();
        printf("\nEnter the array elements : ");
}
```

```
for(i=0;i< 5;i++)
     scanf("%d",&arr[i]);
     printf("\nPassing entire array .....");
      fun(arr);  // Pass only name of array
for(i=0;i< 5;i++)
    printf("\nAfter  Function call a[%d] : %d",i,arr[i]);   getch();
}
```

output

```
Enter the array elements : 1 2 3 4 5
Passing entire array .....
After Function call a[0] : 11
After Function call a[1] : 12
After Function call a[2] : 13
 After Function call a[3] : 14
 After Function call a[4] : 15
```



Passing Entire 1-D Array to Function in C Programming

- Array is passed to function Completely.
- Parameter Passing Method : **Pass by Reference**
- It is Also Called "**Pass by Address**"
- Original Copy is Passed to Function
- Function Body Can Modify **Original Value.**

Example :

```
#include<stdio.h>
#include<conio.h>
 void modify(int b[3]);
 void main()
{
      int arr[3] = {1,2,3};
      modify(arr);
      for(i=0;i<3;i++)
         printf("%d",arr[i]);
     getch();
}
void modify(int a[3])
{
      int i;
     for(i=0;i<3;i++)
    a[i] = a[i]*a[i];
 }
```

Output :

1 4 9

Here **"arr"** is same as **"a"** because Base Address of Array **"arr"** is stored in Array **"a"**

Alternate Way of Writing Function Header :

void modify(int a[3]) **OR** void modify(int *a)

Passing array element by element to function :

- Individual element is passed to function using **Pass By Value** parameter passing scheme
- Original Array elements remains same as Actual Element is never Passed to Function. thus function body cannot modify **Original Value.**
- Suppose we have declared an array 'arr[5]' then its individual elements are arr[0],arr[1]…arr[4]. Thus we need 5 function calls to pass complete array to a function.

Tabular Explanation :

Consider following array

Iteration	Element Passed to Function	Value of Element
1	arr[0]	11
2	arr[1]	22
3	arr[2]	33
4	arr[3]	44
5	arr[4]	55

C Program to Pass Array to Function Element by Element :

```
#include<   stdio.h>     #include<
conio.h>  void fun(int num)
{
          printf("\nElement : %d",num);
 }
 void main()
{
          int arr[5],i;
          clrscr();
          printf("\nEnter the array elements : ");
          for(i=0;i< 5;i++)
            scanf("%d",&arr[i]);
          printf("\nPassing array element by element.....");
          for(i=0;i< 5;i++)
            fun(arr[i]);
          getch();
}
```

Output :

Enter the array elements : 1 2 3 4 5
Passing array element by element.....
Element : 1
Element : 2
Element : 3
Element : 4
Element : 5

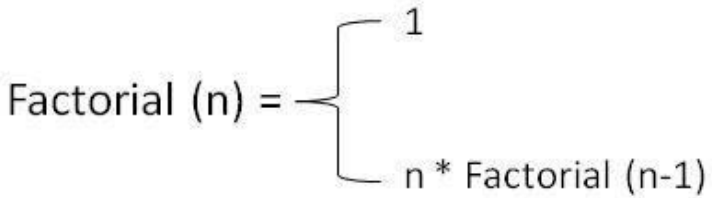
DISADVANTAGE OF THIS SCHEME :

- This type of scheme in which we are calling the function again and again but with **different array element is too much time consuming**. In this scheme we need to call function by pushing the current status into the system stack.
- It is better to pass complete array to the function so that we can save some system time required for pushing and popping.

18. RECURSION CONCEPT :

- Recursion is **basic concept** in Programming.
- When Function is defined in terms of itself then it is called as "**Recursion Function**".
- Recursive function is a **function which contains a call to itself**.

```
int factorial(int n)
{
if(n==0)
return(1);
else
return( n * factorial(n-1));
}
```



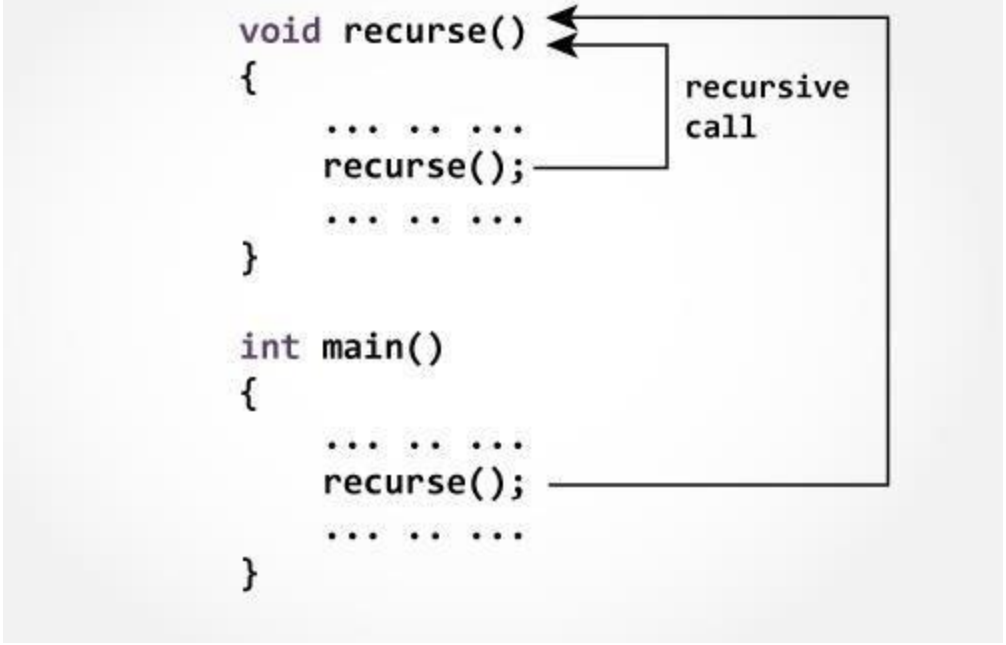
Example:

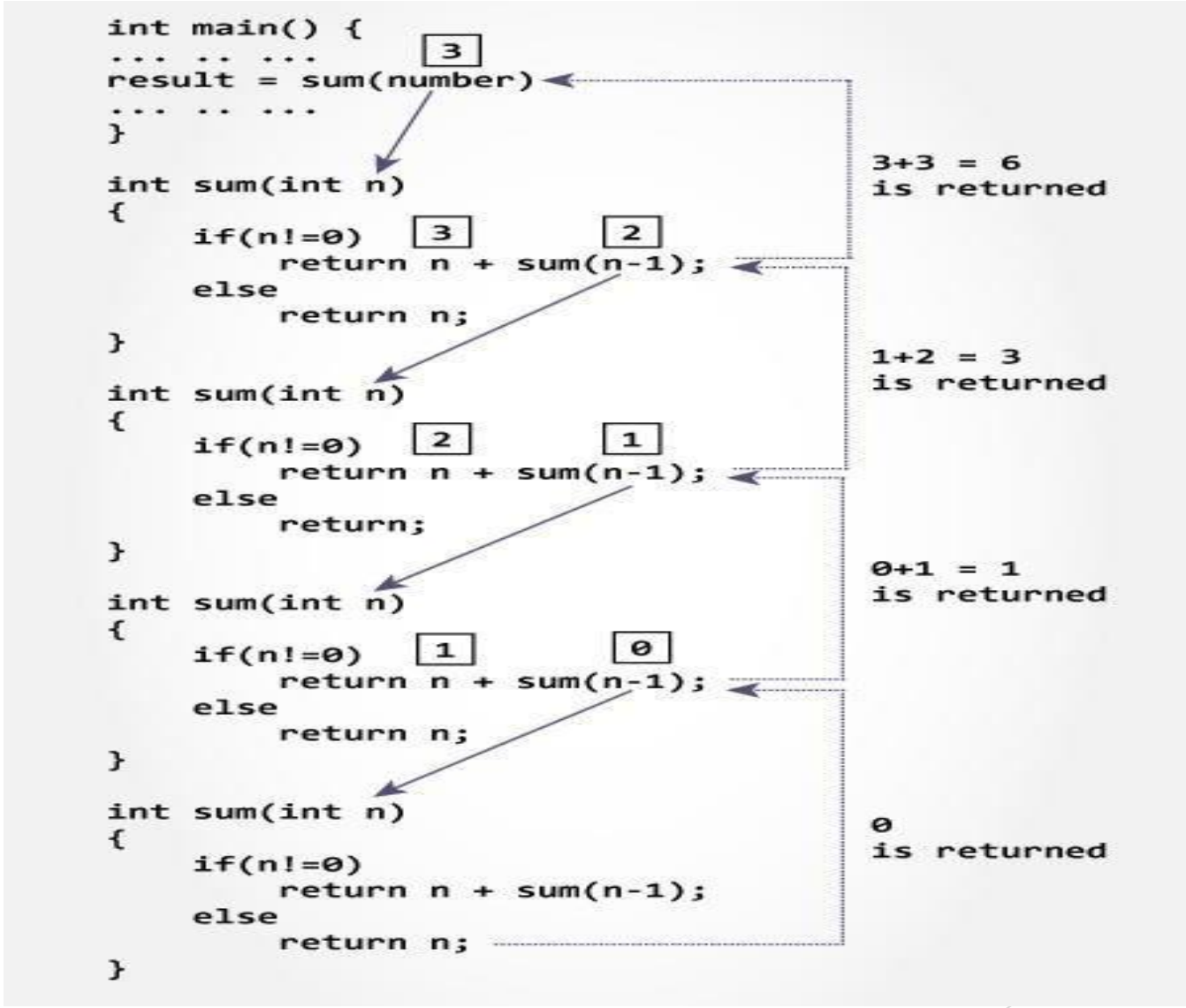
```
#include <stdio.h>
int sum(int n);  int main()
{
        int number, result;
        printf("Enter a positive integer: ");
        scanf("%d", &number);
        result = sum(number);
        printf("sum=%d", result);
}
int sum(int num)
{
        if (num!=0)
                return num + sum(num-1); // sum() function calls itself
        else
        return num;
}
```

Output

```
Enter a positive integer: 3 6
```

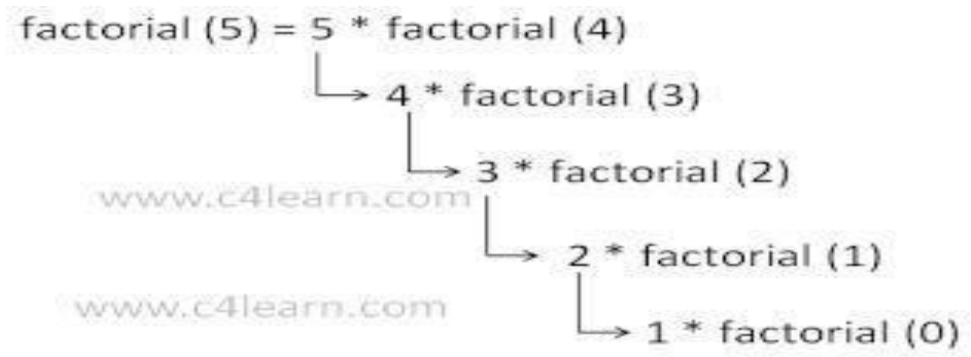
How does recursion work?




int main() {
... .
result = sum(number)
... .
}
3
int sum(int n)
{
if(n!=0)
return n + sum(n-1);
else
return n;
}
3
2
int sum(int n)
{
if(n!=0)
return n + sum(n-1);
else
return;
}
2
1
int sum(int n)
{
if(n!=0)
return n + sum(n-1);
else
return n;
}
1
0
int sum(int n)
{
if(n!=0)
return n + sum(n-1);
else
return n;
}
3+3 = 6
is returned
1+2 = 3
is returned
0+1 = 1
is returned
0
is returned

Warning of using recursive function in C Programming:

- Recursive function must have at least one terminating condition that can be satisfied.
- Otherwise, the recursive function will call itself repeatably until the run time stack overflows.



Advantages and Disadvantages of Recursion

- Recursion makes program elegant and cleaner. All algorithms can be defined recursively which makes it easier to visualize and prove.
- If the speed of the program is vital then, you should avoid using recursion. Recursions use more memory and are generally slow. Instead, you can use loop.