C Language

Overview of C

- C is developed by Dennis Ritchie
- C is a structured programming language
- C supports functions that enables easy maintainability of code, by breaking large file into smaller modules
- Comments in C provides easy readability
- C is a powerful language

Program structure

A sample C Program

```
#include<stdio.h>
int main()
{
  --other statements
}
```

Header files

- The files that are specified in the include section is called as header file
- These are precompiled files that has some functions defined in them
- We can call those functions in our program by supplying parameters
- Header file is given an extension .h
- C Source file is given an extension .c

Main function

- This is the entry point of a program
- When a file is executed, the start point is the main function
- From main function the flow goes as per the programmers choice.
- There may or may not be other functions written by user in a program
- Main function is compulsory for any c program

Writing the first program

```
#include<stdio.h>
int main()
{
  printf("Hello");
  return 0;
}
```

- This program prints Hello on the screen when we execute it

Running a C Program

- Type a program
- Save it
- Compile the program – This will generate an exe file (executable)
- Run the program (Actually the exe created out of compilation will run and not the .c file)
- In different compiler we have different option for compiling and running. We give only the concepts.

Comments in C

- Single line comment
  - // (double slash)
  - Termination of comment is by pressing enter key
- Multi line comment

  /*….

  …….*/

  This can span over to multiple lines

Data types in C

- Primitive data types
  - int, float, double, char
- Aggregate data types
  - Arrays come under this category
  - Arrays can contain collection of int or float or char or double data
- User defined data types
  - Structures and enum fall under this category.

Variables

- Variables are data that will keep on changing
- Declaration

  <<Data type>> <<variable name>>;

  int a;
- Definition

  <<varname>>=<<value>>;

  a=10;
- Usage

  <<varname>>

  a=a+1; //increments the value of a by 1

Variable names– Rules

- Should not be a reserved word like int etc..
- Should start with a letter or an underscore(_)
- Can contain letters, numbers or underscore.
- No other special characters are allowed including space
- Variable names are case sensitive
  - A and a are different.

Input and Output

- Input
  - scanf(“%d”,&a);
  - Gets an integer value from the user and stores it under the name “a”
- Output
  - printf(“%d”,a)
  - Prints the value present in variable a on the screen

For loops

- The syntax of for loop is

```
for(initialisation;condition checking;increment)
{
  set of statements
}
```

Eg: Program to print Hello 10 times

```
for(I=0;I<10;I++)
{
  printf("Hello");
}
```

While loop

- The syntax for while loop

```
while(condn)
{
        statements;
}
```

Eg:

```
a=10;
while(a != 0)
{
        printf("%d",a);
        a--;
}
```

Output: 10987654321

Do While loop

- The syntax of do while loop

```
do
{
   set of statements
}while(condn);
```

Eg:

```
i=10;
do
{
   printf("%d",i);
   i--;
}while(i!=0)
```

Output:

10987654321

Conditional statements

```
if (condition)
{
  stmt 1;          //Executes if Condition is true
}
else
{
  stmt 2;          //Executes if condition is false
}
```

Conditional statement

```
switch(var)
{
case 1:      //if var=1 this case executes
             stmt;
             break;
case 2:      //if var=2 this case executes
             stmt;
             break;
default:     //if var is something else this will
  execute
             stmt;
}
```

Operators

- Arithmetic (+,-,*,/,%)
- Relational (<,>,<=,>=,==,!=)
- Logical (&&,||,!)
- Bitwise (&,|)
- Assignment (=)
- Compound assignment(+=,*=,-=,/=,%=,&=,|=)
- Shift (right shift >>, left shift <<)

String functions

- strlen(str) – To find length of string str
- strrev(str) – Reverses the string str as rts
- strcat(str1,str2) – Appends str2 to str1 and returns str1
- strcpy(st1,st2) – copies the content of st2 to st1
- strcmp(s1,s2) – Compares the two string s1 and s2
- strcmpi(s1,s2) – Case insensitive comparison of strings

Numeric functions

- pow(n,x) – evaluates n^x
- ceil(1.3) – Returns 2
- floor(1.3) – Returns 1
- abs(num) – Returns absolute value
- log(x) – Logarithmic value
- sin(x)
- cos(x)
- tan(x)

Procedures

- Procedure is a function whose return type is void
- Functions will have return types int, char, double, float or even structs and arrays
- Return type is the data type of the value that is returned to the calling point after the called function execution completes

Functions and Parameters

- Syntax of function

Declaration section

<<Returntype>> funname(parameter list);

Definition section

<<Returntype>> funname(parameter list)

{

body of the function

}

Function Call

Funname(parameter);

Example function

```
#include<stdio.h>
void fun(int a);            //declaration
int main()
{
  fun(10);                  //Call
}
void fun(int x)             //definition
{
  printf("%d",x);
}
```

Actual and Formal parameters

- Actual parameters are those that are used during a function call
- Formal parameters are those that are used in function definition and function declaration

Arrays

- Arrays fall under aggregate data type
- Aggregate – More than 1
- Arrays are collection of data that belong to same data type
- Arrays are collection of homogeneous data
- Array elements can be accessed by its position in the array called as index

Arrays

- Array index starts with zero
- The last index in an array is num – 1 where num is the no of elements in a array
- int a[5] is an array that stores 5 integers
- a[0] is the first element where as a[4] is the fifth element
- We can also have arrays with more than one dimension
- float a[5][5] is a two dimensional array. It can store 5x5 = 25 floating point numbers
- The bounds are a[0][0] to a[4][4]

Structures

- Structures are user defined data types
- It is a collection of heterogeneous data
- It can have integer, float, double or character data in it
- We can also have array of structures

```
struct <<structname>>
{
  members;
}element;
```

We can access element.members;

Structures

```
struct Person
{
int id;
char name[5];
}P1;
P1.id = 1;
P1.name = “vasu”;
```

Type def

- The typedef operator is used for creating alias of a data type
- For example I have this statement

  typedef int integer;

  Now I can use integer in place of int

  i.e instead of declaring int a;, I can use

  integer a;

  This is applied for structures too.

Pointers

- Pointer is a special variable that stores address of another variable
- Addresses are integers. Hence pointer stores integer data
- Size of pointer = size of int
- Pointer that stores address of integer variable is called as integer pointer and is declared as int *ip;

Pointers

- Pointers that store address of a double, char and float are called as double pointer, character pointer and float pointer respectively.
- char *cp
- float *fp
- double *dp;
- Assigning value to a pointer

  int *ip = &a; //a is an int already declared

Examples

```
int a;
a=10;       //a stores 10
int *ip;
ip = &a;    //ip stores address of a (say 1000)

ip          :       fetches 1000
*ip   :     fetches 10
* Is called as dereferencing operator
```

Call by Value

- Calling a function with parameters passed as values

```
int a=10;                    void fun(int a)
fun(a);                      {
                                     defn;
                             }
```

Here fun(a) is a call by value.

Any modification done with in the function is local to it and will not be effected outside the function

Call by reference

- Calling a function by passing pointers as parameters (address of variables is passed instead of variables)

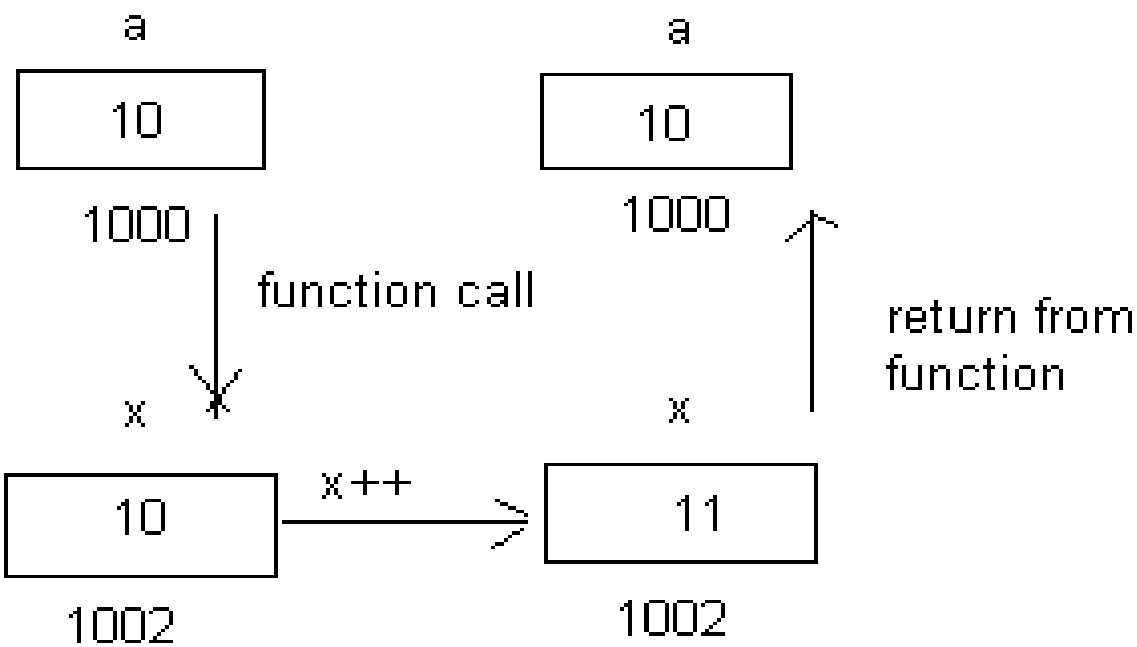
```
int a=1;                    void fun(int *x)
fun(&a);                    {
                                    defn;
                            }
```

Any modification done to variable a will effect outside the function also

Example program – Call by value

```
#include<stdio.h>
void main()
{
    int a=10;
    printf("%d",a);              a=10
    fun(a);
    printf("%d",a);              a=10
}
void fun(int x)
{
    printf("%d",x)               x=10
    x++;
    printf("%d",x);              x=11
}
```

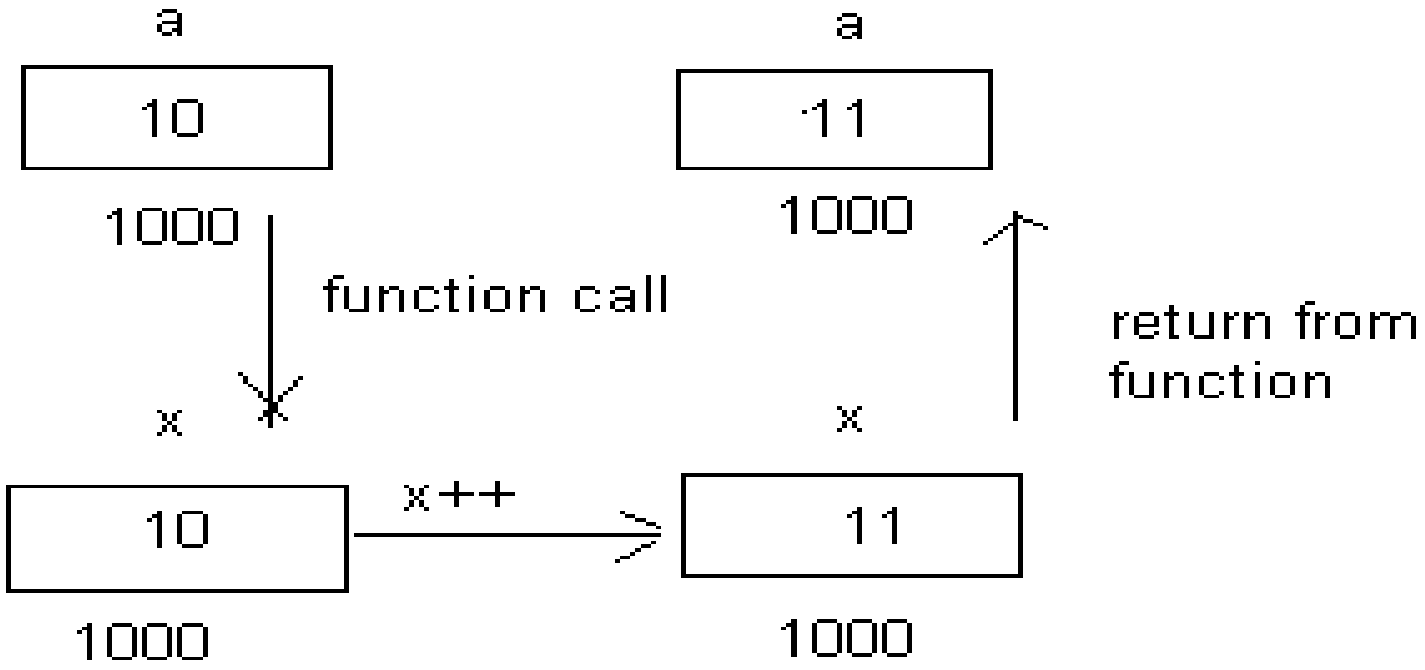
Explanation



Example Program – Call by reference

```
#include<stdio.h>
void main()
{
    int a=10;
    printf("%d",a);              a=10
    fun(a);
    printf("%d",a);              a=11
}
void fun(int x)
{
    printf("%d",x)               x=10
    x++;
    printf("%d",x);              x=11
}
```

Explanation



a and x are referring to same location. So value will be over written.

Conclusion

- Call by value => copying value of variable in another variable. So any change made in the copy will not affect the original location.
- Call by reference => Creating link for the parameter to the original location. Since the address is same, changes to the parameter will refer to original location and the value will be over written.