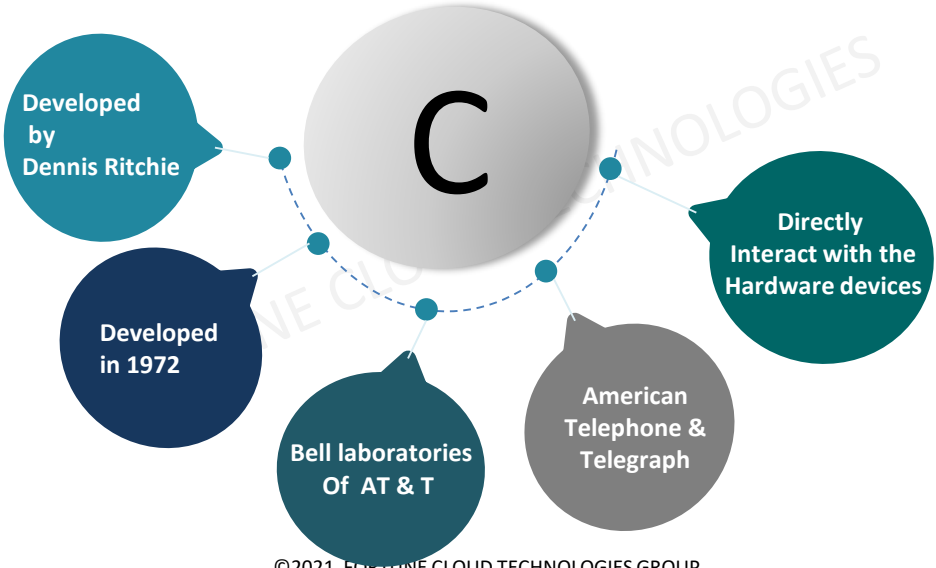
FortuneCloud
We Understand Technology

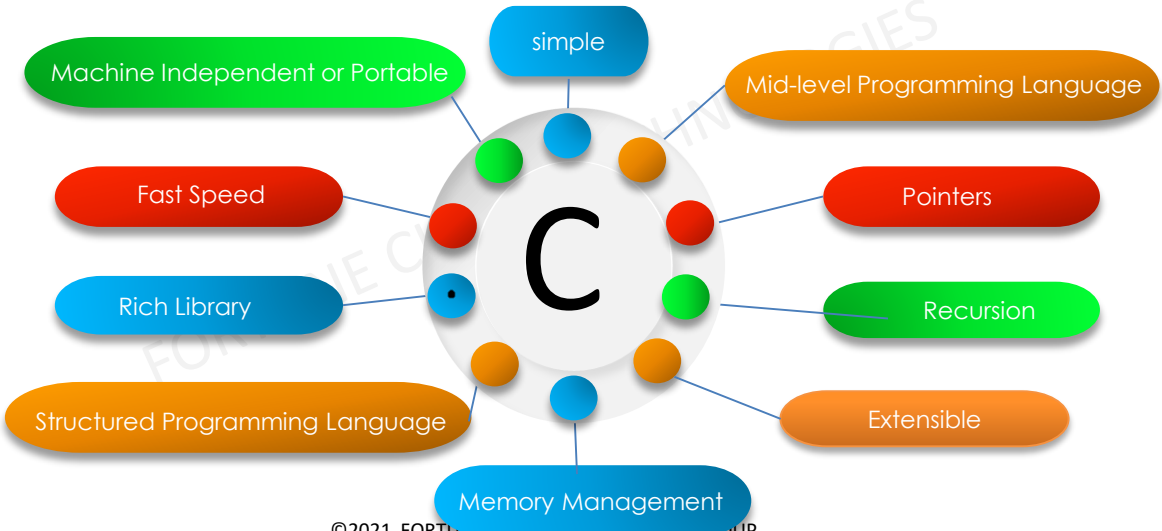
C Language - eBook

Fortune Cloud Technologies Group
2nd Floor, Abhinav Apartment, Beside Congress Bhavan, Shivaji Nagar, Pune - 411005
Landmark: Near Pune Municipal Corporation (Ma.na.pa) Bus Stand, Pune
Contact No: 9766439090 / 7083777567
Website: www.fortunecloudindia.com

History

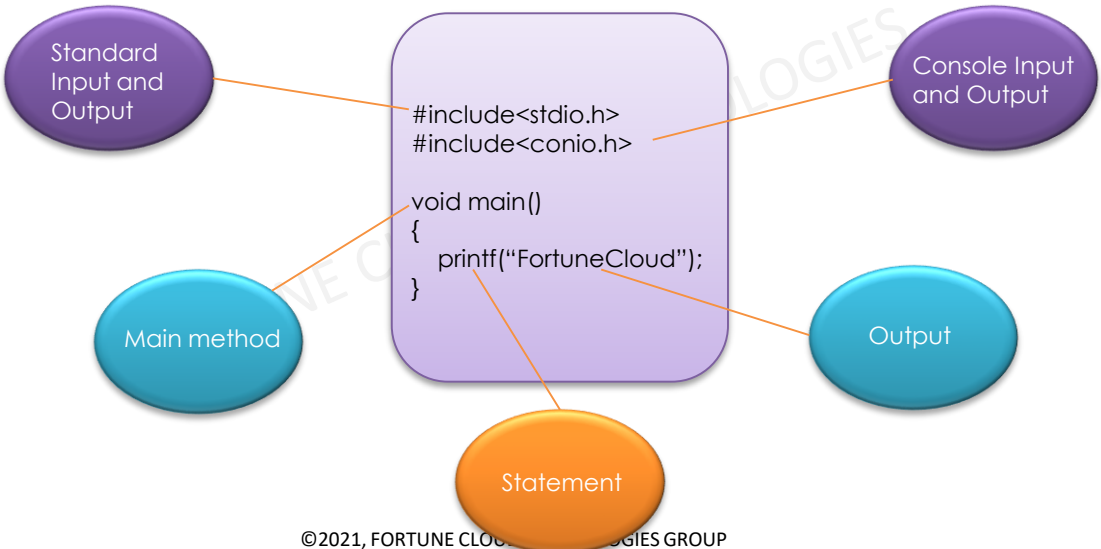


Features



FortuneCloud
We Understand Technology

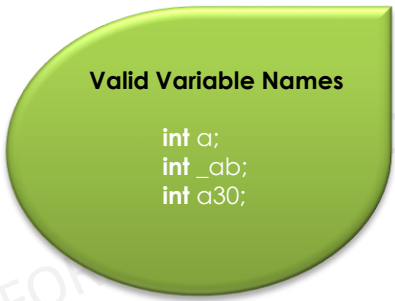
Introduction to first program

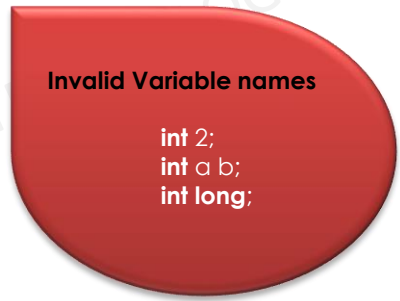


- A variable is a name of the memory location.
- A variable is nothing but a name given to a storage area.
- The name of a variable can be composed of letters, digits, and the underscore character.

Rules for defining variables

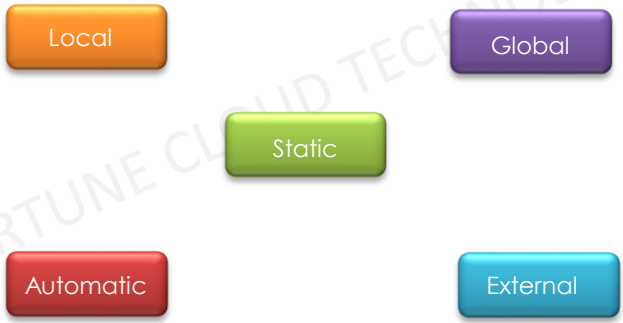
- A variable can have alphabets, digits, and underscore.
- A variable name can start with the alphabet, and underscore only.
- It can't start with a digit.
- No whitespace is allowed within the variable name.
- A variable name must not be any reserved word or keyword, e.g. int, float, etc.





FortuneCloud
We Understand Technology

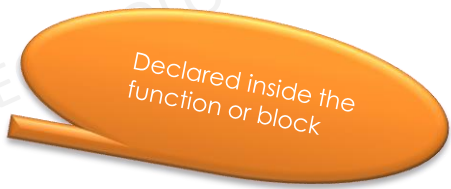
Types of Variables



FortuneCloud
We Understand Technology

Local Variable

```
void display()
{
    int a=10;    //local variable
}
```



FortuneCloud
We Understand Technology

Global Variable

```
int value=20;    //global variable

void display()
{
   printf("Hi");
}
```

- Declared outside the function or block
- Any function can change the value of the global variable.

FortuneCloud
We Understand Technology

Static Variable

```
void display()
{
    int a=10;   //local variable
    static int b=10;    //static variable

    a=a+1;
    b=b+1;
    printf("\n%d,%d",a,b);
}

void main()
{
        display();
        display();
        display();
}
```

Declared with the static keyword

Output:

11,11
11,12
11,13

Automatic Variable

```
void main()
{
    int a=10;   //local variable  (also automatic)

    auto int b=20;    // automatic variable
}
```

- All variables in C that are declared inside the block, are automatic variables by default.

External Variable

```
#include<stdio.h>
#include<conio.h>

extern int e=50;  // external variable

void main()
{
    printf("%d",e);
}
```

- Also known as global variable
- Defined outside the function
- They are everywhere in the program

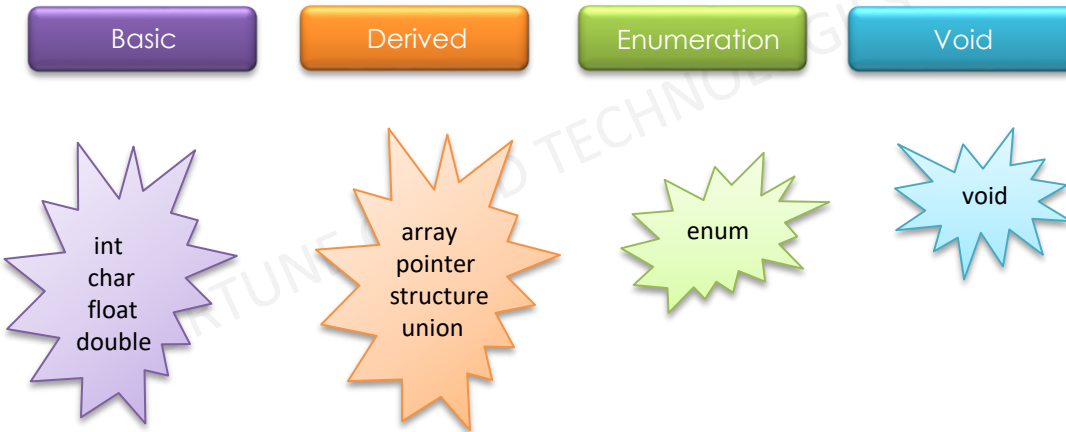
extensive system used for declaring variables or functions of different types

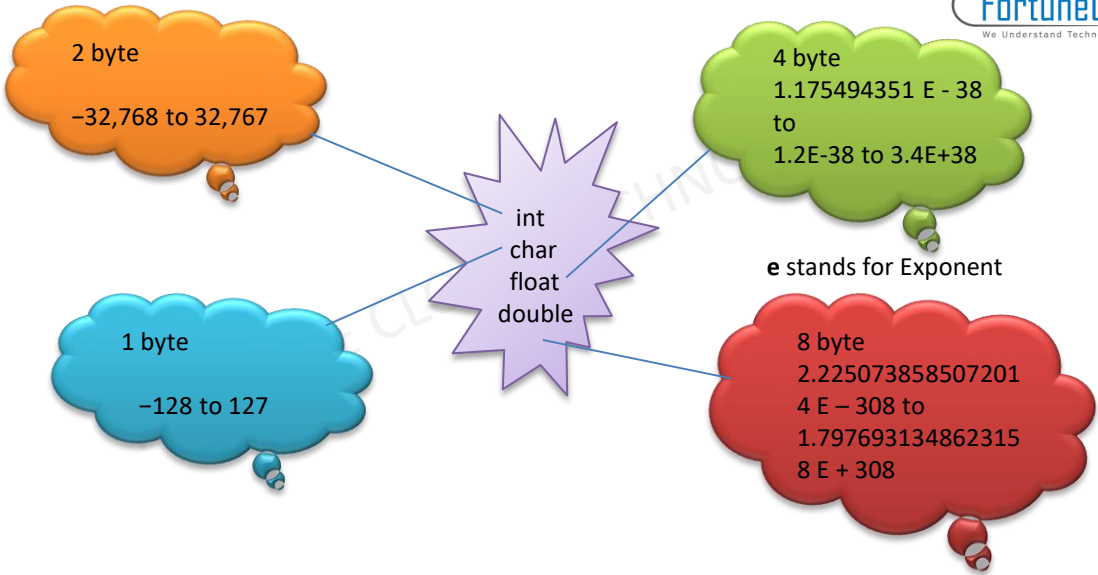
The type of a variable determines how much space it occupies in storage

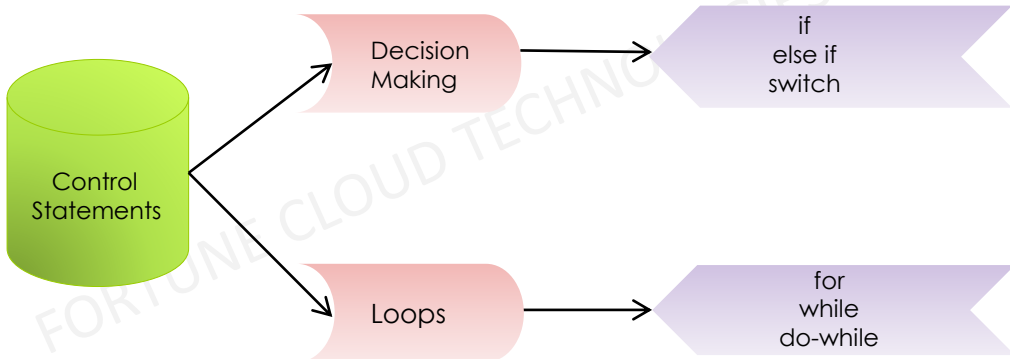
It specifies the type of data that a variable can store such as integer, floating, character, etc.

FortuneCloud
We Understand Technology

Datatypes in C

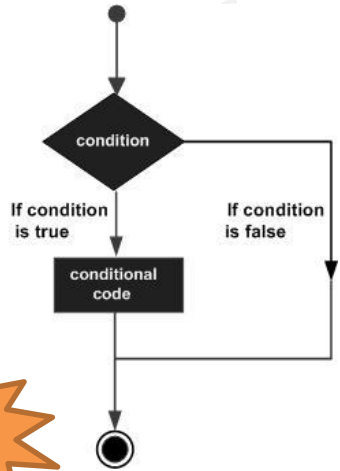






Decision Making

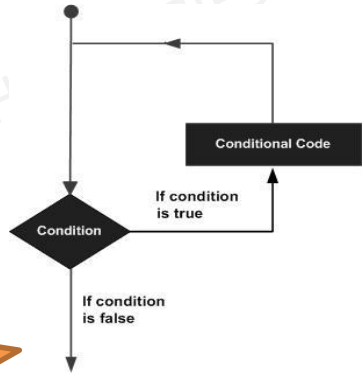
- one or more conditions to be evaluated or tested by the program
- statement or statements to be executed if the condition is determined to be true
- other statements to be executed if the condition is determined to be false



if
else if
switch

Loops

- block of code needs to be executed several number of times
- statements are executed sequentially



for
while
do-while

FortuneCloud
We Understand Technology

```
if(expression)
{
  //code to be executed
}
```

- check some given condition and perform some operations depending upon the correctness of that condition

```
if(expression)
{
   //code to be executed
}
else
{
   //code to be executed if condition is false
}
```

Example

Ex. Even odd number

```
int num=10;

if(num%2==0)
{
   printf("Even Number");
}
else
{
  printf("Odd Number");
}
```

else if

FortuneCloud
We Understand Technology

```
if(condition1)
{
     //code to be executed if condition1 is true
}
else if(condition2)
{
    //code to be executed if condition2 is true
}
else if(condition3)
{
    //code to be executed if condition3 is true
}
Else
{
  //code to be executed if all the conditions are false
}
```

Multiple cases to be performed for different conditions

Example

Ex. Display days name

```
int day=1;

if(day==1)
{
   printf("Sunday");
}
else if(day==2)
{
  printf("Monday");
}
.....
else
{
  printf("Day not found");
}
```

FortuneCloud
We Understand Technology

```
switch(expression)
{
    case value1:
        //code to be executed;
        break;

    case value2:
        //code to be executed;
        break;
    .....

    default:
        code to be executed if all cases are not matched;
}
```

Alternate to if-else-if statement which allows us to execute multiple operations

Example

```
int choice=1;

switch(choice)
{
   case 1:
     printf("Case 1 executed");
     break;

   case 2:
     printf("Case 2 executed");
     break;

   default:
      printf("Wrong choice");
}
```

Loops → for

FortuneCloud
We Understand Technology

```
for(initialization;condition;incr/decr)
{
    //code to be executed
}
```

iterate the statements or a part of the program several times
used to traverse the data structures like the array and linked list.

Example

Ex. Display 1 to 10 numbers

```
int i;

for(i=1;i<=10;i++)
{
   printf("%d",i);
}
```

FortuneCloud
We Understand Technology

```
while(condition)
{
   //code to be executed
}
```

Mostly used in the case where the number of iterations is not known in advance.

Example

Ex. Display 1 to 10 numbers

```
int i=1;

while(i<=10)
{
   printf("%d",i);
   i++;
}
```

FortuneCloud
We Understand Technology

```
do
{
   //code to be executed
} while(condition);
```

- post tested loop
- repeat the execution of several parts of the statements
- termination condition depends upon the end user.

Example

Ex. Display 1 to 10 numbers

```
int i=1;

do
{
   printf("%d",i);
   i++;
} while(i<=10);
```

FortuneCloud
We Understand Technology

Difference between while and do-while

- While loop is executed only when given condition is true.
- Condition is checked first then statement(s) is executed.
- while loop is entry controlled loop.

- do-while loop is executed for first time irrespective of the condition. After executing while loop for first time, then condition is checked.
- Statement(s) is executed atleast once, thereafter condition is checked.
- do-while loop is exit controlled loop.

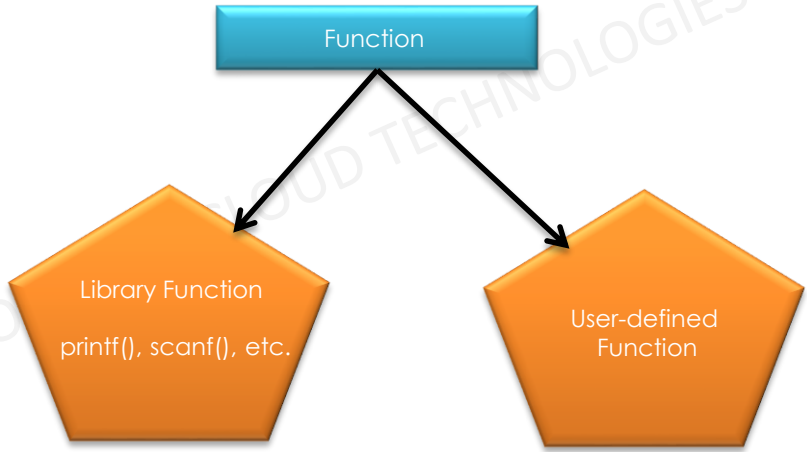
- we can divide a large program into the basic building blocks known as function.
- It contains the set of programming statements enclosed by {}.

Advantages

- we can avoid rewriting same logic/code again and again.
- We can call C functions any number of times in a program.
- We can track a large C program easily when it is divided into multiple functions.
- Reusability is the main achievement.

FortuneCloud
We Understand Technology

Types of Functions



FortuneCloud
We Understand Technology

User-defined function

Default Function

```
void display()
{
    printf("default function");
}

void main()
{
    display();
}
```

Parameterized Function

```
void addition(int a, int b)
{
    int c;
    c=a+b;
    printf("addition=%d",c);
}

void main()
{
    addition(10,20);
}
```

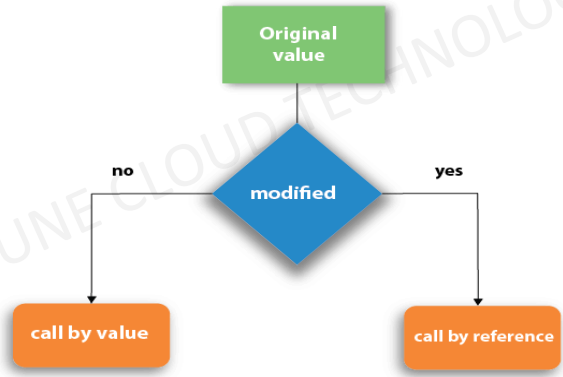
User-defined function

FortuneCloud
We Understand Technology

Function with return

```
int addition(int a, int b)
{
    int c;
    c=a+b;
    return c;
}

void main()
{
    printf("%d",addition(10,20));
}
```

Call by value and Call by reference



Call by value

```
void show(int num)
 {
   printf("\nBefore adding=%d",num);
   num=num+10;
   printf("\nAfter adding=%d", num);
}

int main()
{
   int a=10;
   printf("\nBefore function call a=%d", a);

   show(a);

   printf("\nAfter function call a=%d", a);

   return 0;
}
```

- value of the actual parameters is copied into the formal parameters
- can not modify the value of the actual parameter
- different memory is allocated for actual and formal parameters

Call by reference

```
void show(int *num)
 {
   printf("\nBefore adding=%d",*num);
   (*num)+=10;
   printf("\nAfter adding=%d", *num);
}

int main()
{
   int a=10;
   printf("\nBefore function call a=%d", a);

   show(&a);

   printf("\nAfter function call a=%d", a);

   return 0;
}
```

- the address of the variable is passed into the function call as the actual parameter.
- the memory allocation is similar for both formal parameters and actual parameters.
- modified value gets stored at the same address.

- fixed-size sequential collection of elements of the same type.
- collection of similar type of data items stored at contiguous memory locations.
- store the primitive type of data such as int, char, double, float, etc.
- each data element can be randomly accessed by using its index number.
- All arrays consist of contiguous memory locations.
- The lowest address corresponds to the first element and the highest address to the last element.

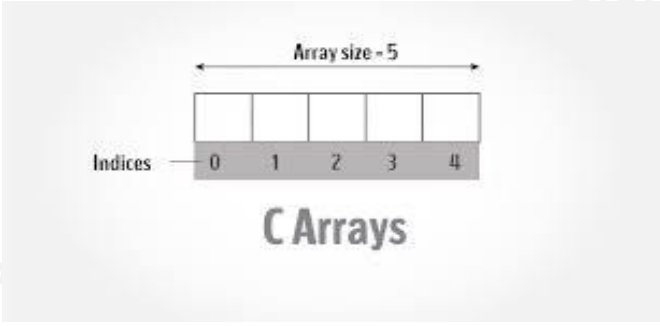
Advantages

Code Optimization

Ease of traversing

Ease of sorting

Random Access



FortuneCloud
We Understand Technology

Types of Array

One dimensional array

Two dimensional array

Multi-dimensional array

One dimensional array

```
int num[3];

num[0]=10;//initialization of array
num[1]=20;
num[2]=30;

printf("%d",num[0]);
printf("%d",num[1]);
printf("%d",num[2]);
```

OR

```
int i;
for(i=0;i<3;i++)
{
   printf("%d ",num[i]);
}
```

Two dimensional array

FortuneCloud
We Understand Technology

```
int num[2][2]={{1,2},{3,4}};


int i,j;
for(i=0;i<2;i++)
{
   for(j=0;j<2;j++)
   {
      printf("%d ",num[i][j]);
   }
}
```

Multi-dimensional array

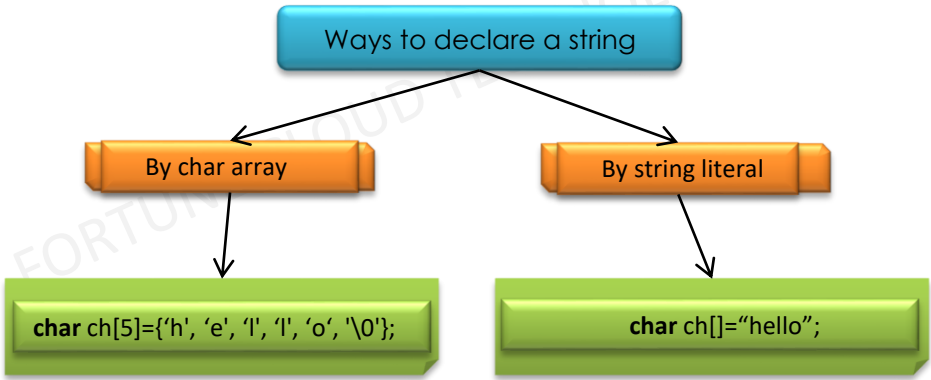
FortuneCloud
We Understand Technology

```
int num[2][2][2];


int i,j,k;

for(i=0;i<2;i++)
{
  for(j=0;j<2;j++)
  {
      for(k=0;k<2;k++)
      {
          printf("%d ",num[i][j][k]);
      }
  }
}
```

Example: Find out sum of elements in a given array

```
int num[5];
int i,sum=0;

printf("Enter the array elements");

for(i=0;i<5;i++)
{
   scanf("%d",&num[i]);
}

for(i=0;i<5;i++)
{
   sum=sum+num[i];
}

printf("Sum=%d",sum);
```

- one-dimensional array of characters terminated by a **null** character '\0'.
- The character array or the string is used to manipulate text such as word or sentences.



gets() and puts()

```
char str[30];

printf("Enter the string");
scanf("%s",&str);

printf("String=%s",str);
```

Both the functions are involved in the input/output operations of the strings

```
char str[30];

printf("Enter the string");
gets(str);

printf("String=");
puts(str);
```

```
char ch1[10]="hello";
char ch2[10]="world";
char ch3[10];
```

String Functions

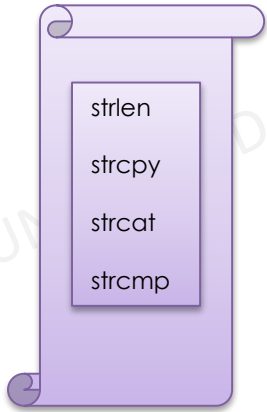
FortuneCloud
We Understand Technology

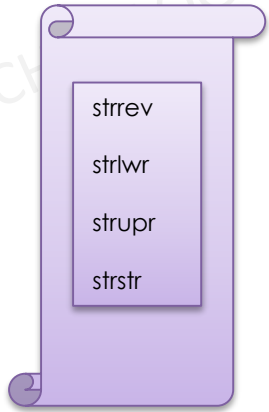
strlen(ch1)

strcpy(ch3,ch1)

strcat(ch1,ch2)

strcmp(ch1,ch2)





strrev(ch1)

strlwr(ch1)

strupr(ch1)

strstr(ch1,"substring")

Example: Count number of vowels in a string

```
char str[100];
int i=0, count=0;

printf("Enter a string\n");
gets(str);

while (str[i] != '\0')
 {
   if (str[i] == 'a' || str[i]  == 'A' || str[i]  == 'e' || str[i]  == '
E' || str[i]  == 'i' || str[i]  == 'I' || str[i]  =='o' || str[i] =='O'
 || str[i]  == 'u' || str[i]  == 'U')
     count++;
   i++;
 }
 printf("Number of vowels in the string: %d", count);
 return 0;
```

Structure-Union

- Structure in c is a user-defined data type that enables us to store the collection of different data types.
- Each element of a structure is called a member.
- **struct** keyword is used to define the structure.

Why use structure

- There are cases where we need to store multiple attributes of an entity.
- It can have different attributes of different data types.

Declaring Structure

FortuneCloud
We Understand Technology

By struct keyword

```
struct employee
{   int id;
    char name[20];
    float salary;
};
```

```
struct employee e1, e2;
```

By declaring a variable

```
struct employee
{   int id;
    char name[20];
    float salary;
}e1,e2;
```

Example:

```
struct employee
{   int id;
    char name[20];
}e1;

int main( )
{
  e1.id=101;
  strcpy(e1.name, "abc");

  printf( "Id : %d", e1.id);
  printf( "\nName : %s", e1.name);
return 0;
}
```

FortuneCloud
We Understand Technology

Array of structure

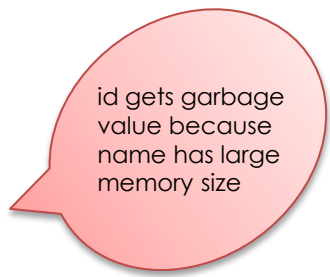
collection of multiple structures variables

```
struct student
{
    int id;
    char name[10];
};

int main()
{
  struct student s[5];
  int i;

for(i=0;i<5;i++){
   printf("\nEnter Id:");
   scanf("%d",&s[i].id);
   printf("\nEnter Name:");
   scanf("%s",&s[i].name);
}
printf("\nStudent Information\n");

for(i=0;i<5;i++){
printf("\nId:%d, Name:%s",s[i].id,s[i].name);
}
  return 0;
}
```

Union

- Store different data types in the same memory location
- It **occupies less memory** because it occupies the size of the largest member only.

```
union employee
{   int id;
    char name[20];
}e1;

void main()
{
  e1.id=101;
  strcpy(e1.name, "abcd");

  printf( "id : %d\n", e1.id);
  printf( "name : %s\n", e1.name);
}
```



FortuneCloud
We Understand Technology

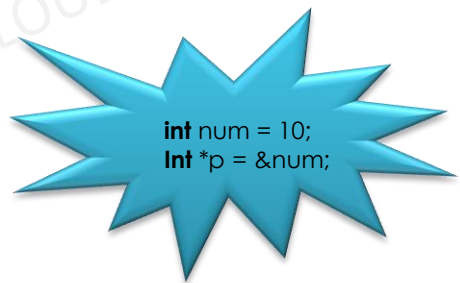
Difference Between Structure And Union

- Separate memory location is allotted to each input member
- **struct** student
  {
  int id;
  char name[20];
  } ;
- Size of Structure is equal or greater than the sum of size of all the data members.

- Memory is allocated only to one member having largest size among all other input variables
- **union** student
  {
  int id;
  char name[20];
  } ;
- Its size equal to the size of largest member among all data members.

- A **pointer** is a variable whose value is the address of another variable, i.e., direct address of the memory location.
- The pointer in C language is a variable which stores the address of another variable.
- This variable can be of type int, char, array, function, or any other pointer.

Example



Advantages

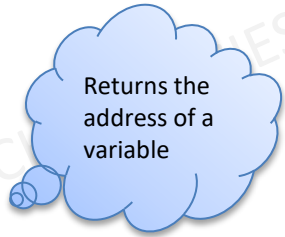
FortuneCloud
We Understand Technology

Pointer **reduces the code** and **improves the performance**

It makes you able to **access any memory location**

We can **return multiple values from a function**

Address Of (&) Operator




```
int num=10;

printf("value of number is %d",num);

printf("address of number is %u",&num);
```

NULL Pointer

- A pointer that is not assigned any value but NULL is known as the NULL pointer.

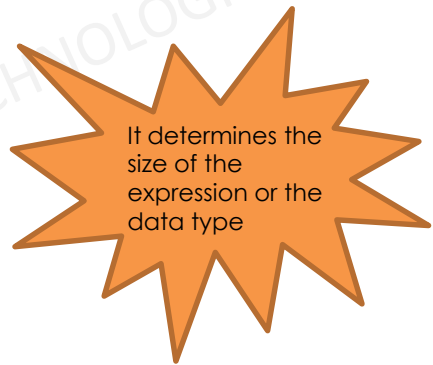
```
int *ptr=NULL;

   if(ptr!=NULL)
   {
      printf("value of ptr is : %d",*ptr);
   }
   else
   {
      printf("Null pointer");
   }
```

Pointer Arithmetic

```
int a=10,b=20,c;
int *p,*q;

p=&a;
q=&b;

c=*p+*q;

printf("addition: %d",c);
```

sizeof() operator

```
int a=10;


printf("%d",sizeof(a));

//sizeof(int);
//sizeof(char);
//sizeof(float);
```



Function pointer

```
int (*p) (int , int);    //Declaration of a function pointer.

int add( int , int );    // Declaration of  function.

p = add;  // Assigning address of add to the p pointer.
```

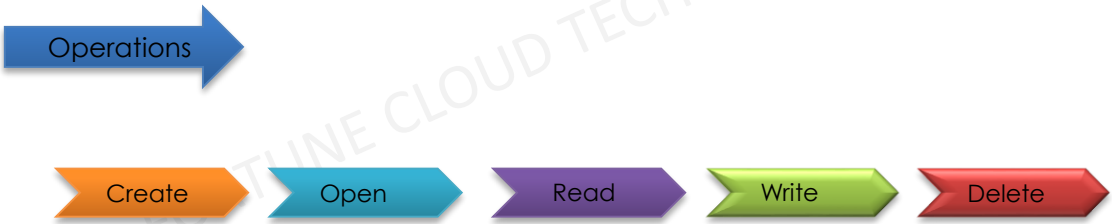
We can get the address of memory by using the function pointer.

Example

```
int add(int a, int b)
{
   int c;
   c=a+b;
   return c;
}
```

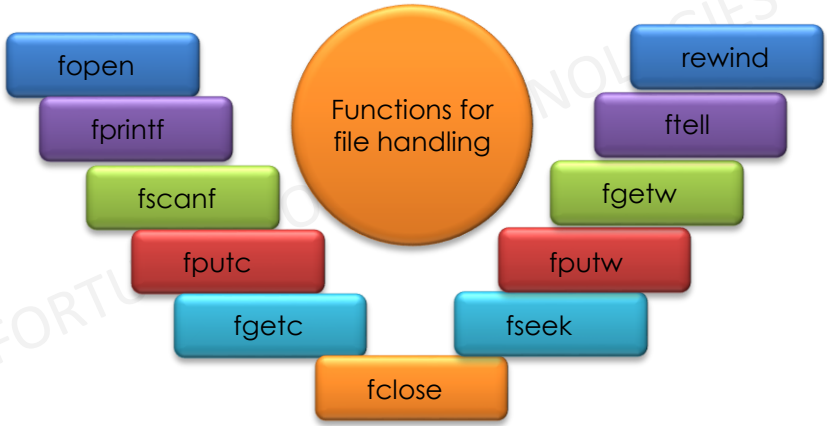
```
int main()
{
  int a,b;

  int (*p)(int,int);

  int result;
  printf("Enter  a and b : ");
  scanf("%d%d",&a,&b);

  p=add;

  result=(*p)(a,b);

  printf("Addition: %d",result);

   return 0;
}
```

- **File Handling** is the storing of data in a **file** using a program.
- File handling in C enables us to create, update, read, and delete the files stored on the local file system through our C program.



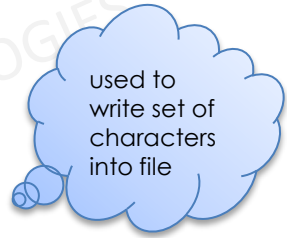
Modes

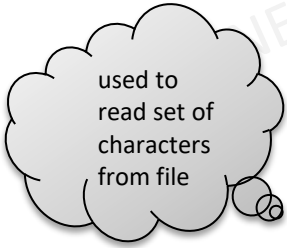
r	Opens an existing text file for reading purpose.
w	Opens a text file for writing. If it does not exist, then a new file is created.
a	Opens a text file for writing in appending mode. If it does not exist, then a new file is created.
r+	Opens a text file for both reading and writing.
W+	Opens a text file for both reading and writing. It first truncates the file to zero length if it exists, otherwise creates a file if it does not exist.
a+	Opens a text file for both reading and writing. It creates the file if it does not exist. The reading will start from the beginning but writing can only be appended.



fprintf() and fscanf()

```
FILE *fp;
fp = fopen("file.txt", "w");//opening file

fprintf(fp, "Hello file by fprintf...\n");//writing data into file

fclose(fp);//closing file
```

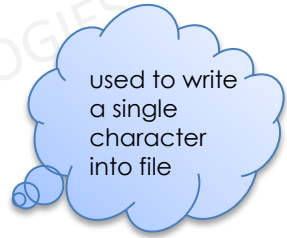





```
FILE *fp;
char buff[255];//creating char array to store data of file
fp = fopen("file.txt", "r");

while(fscanf(fp, "%s", buff)!=EOF)
{
   printf("%s ", buff );
}
fclose(fp);
```

fputc() and fgetc()

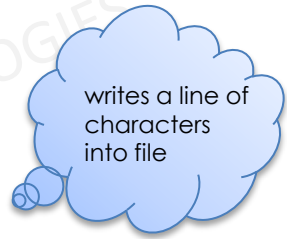
```
FILE *fp;
fp = fopen("file.txt", "w");//opening file

fputc('a',fp);//writing single character into file

fclose(fp);//closing file
```

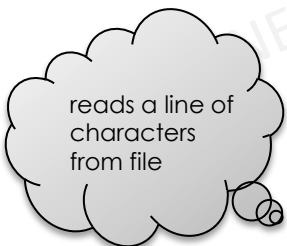



```
FILE *fp;
char c;

fp=fopen("file.txt","r");

while((c=fgetc(fp))!=EOF)
{
   printf("%c",c);
}
fclose(fp);
```

fputs() and fgets()

```
FILE *fp;

fp=fopen("myfile.txt","w");
fputs("hello c programming",fp);

fclose(fp);
```






```
FILE *fp;
char text[300];

fp=fopen("myfile.txt","r");
printf("%s",fgets(text,200,fp));

fclose(fp);
```

FortuneCloud
We Understand Technology

fseek()

```
FILE *fp;

fp = fopen("myfile.txt","w+");

fputs("C programming", fp);

fseek( fp, 7, SEEK_SET );

fputs("Practical", fp);

fclose(fp);
```

It is used to set the file pointer to the specified offset. It is used to write data into file at desired location.

rewind()

- sets the file pointer at the beginning of the stream
- It is useful if you have to use stream many times.

```
FILE *fp;
char c;

fp=fopen("file.txt","r");

while((c=fgetc(fp))!=EOF){
printf("%c",c);
}

rewind(fp);

while((c=fgetc(fp))!=EOF){
printf("%c",c);
}

fclose(fp);
```

ftell()

```
FILE *fp;
int length;

fp = fopen("file.txt", "r");
fseek(fp, 0, SEEK_END);

length = ftell(fp);

fclose(fp);

printf("Size of file: %d bytes", length);
```

- returns the current file position of the specified stream
- get the total size of a file after moving file pointer at the end of file.

FortuneCloud
We Understand Technology