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CHAPTER-4

ARRAY & POINTERS

- Types of arrays
  - Single Dimensional Array
  - Two Dimensional Array or Multi-Dimensional Array
  - String Arrays
- Use of arrays in Programming
- Arrays and matrices
- Introduction of Pointers
- Use of pointers in Dynamic Programming
- Pointer to Variables
- Pointer to Array
- Pointer within Array
- Pointer To Structure
- Pointers within structure
- Pointer to Pointer

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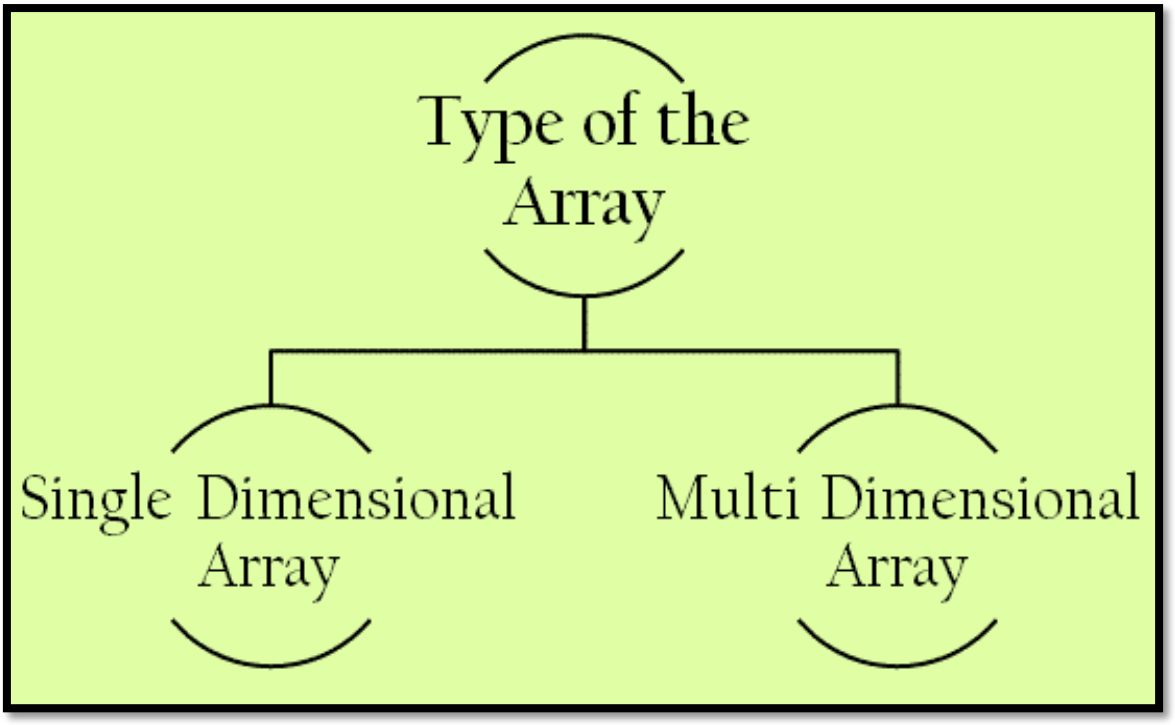
Q-1 What is Array ? Explain with types.



Detail :-

- Array is a group of elements that all have same data type.
- It is a data structure that can store multiple values at the same time in singlevariable.

✓ **How to declare array:- [1 mark]**

- Array can be declare at design time and at run time.
- To declare array , C language provide 3 criterias:
  - (i) Name of Array
  - (ii) Size of Array
  - (iii) Type of Array

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Ex :- int a[3];

❖ **Types of Array :-**

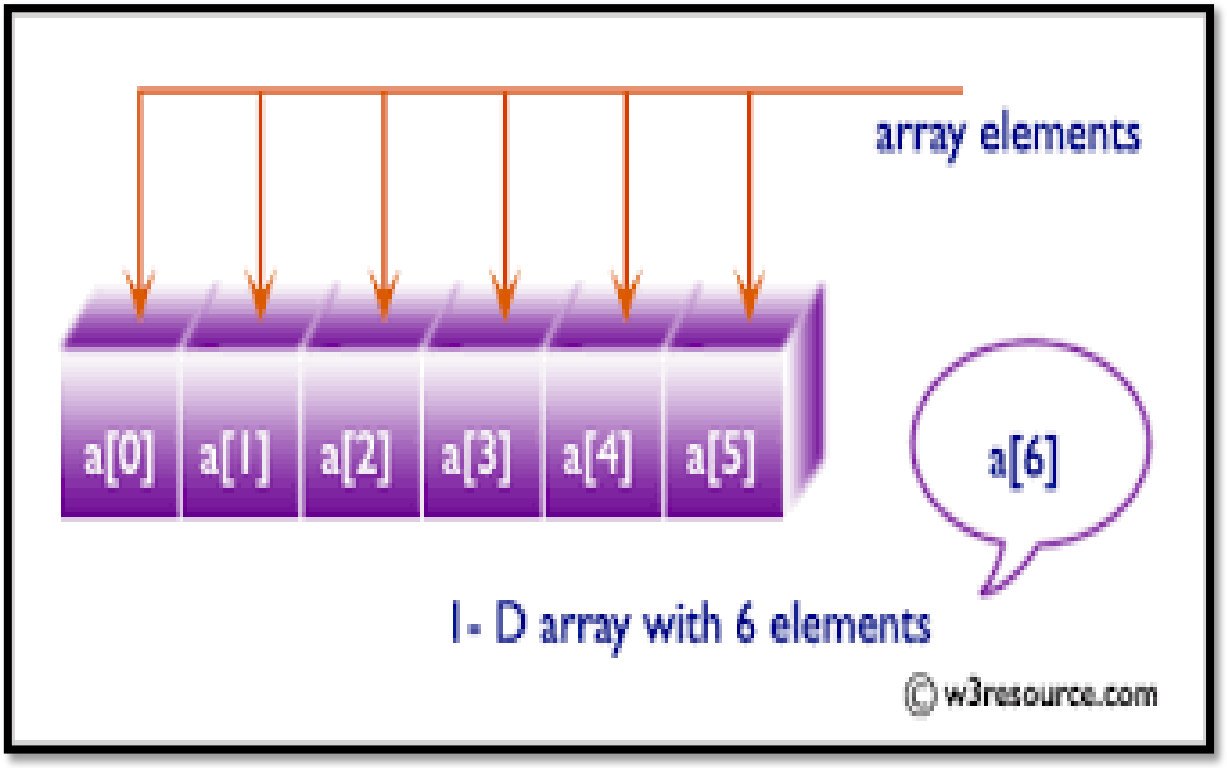
- Array can be of following types:
  - (i) One dimension array (1 - D)
  - (ii) Two dimension array (2 - D)
  - (iii) Multi dimension array (M – D)

✓ **One dimension array (1 - D) :-**

- 1 – D means if we provide only one dimension (one square bracket) withsize.

Syntax :- <data type> <array name> [size of array]

Example :- int a[5];



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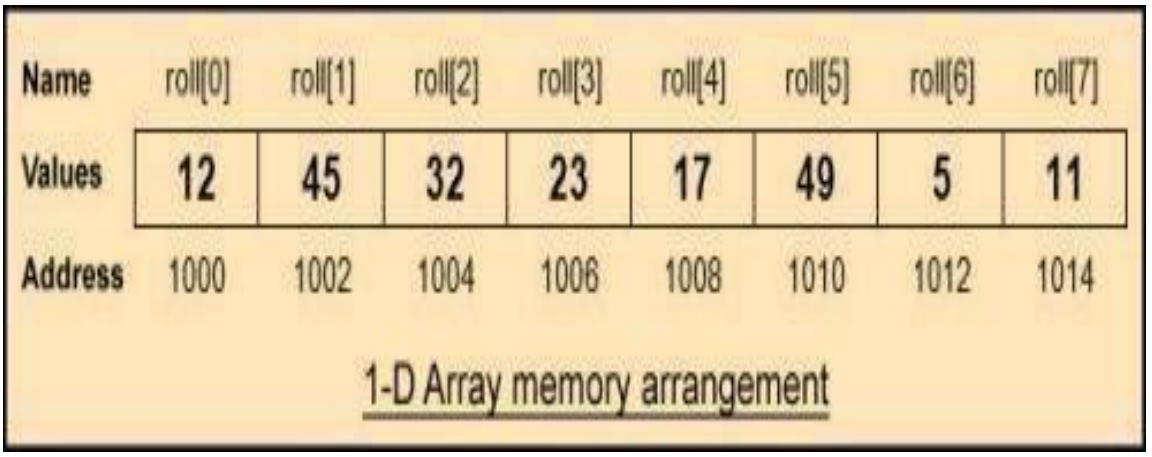
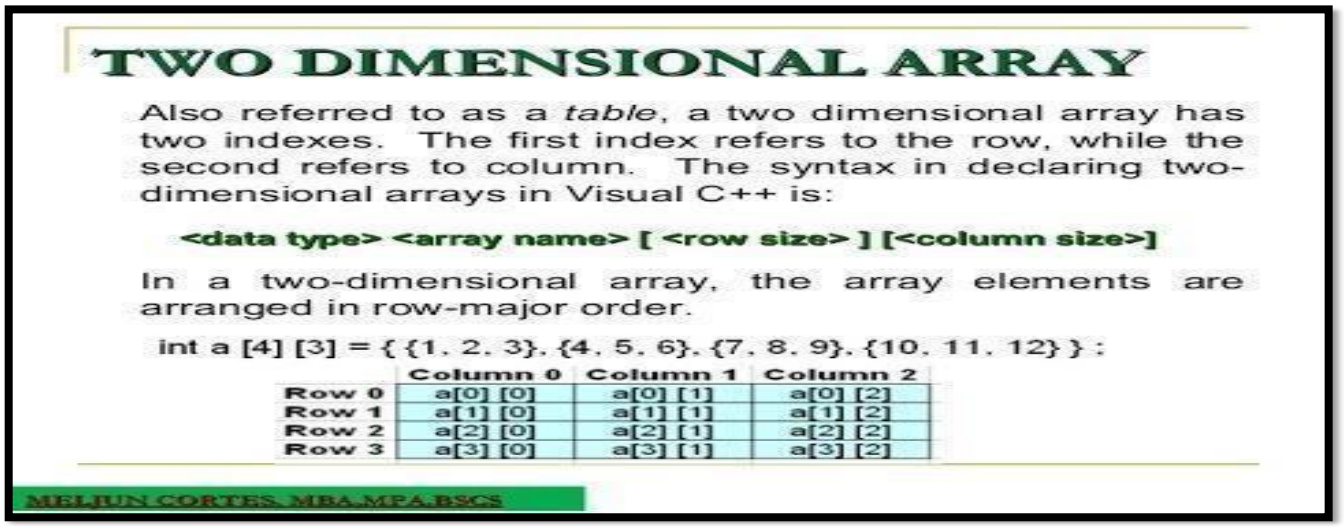


✓ **Two dimension array (2 - D) :-**

- In 2 – D array ,we have to provide two dimenstions (two square brackets)with size.
- One bracket for row & other bracket for column
- We can create table , matrix using 2- D array.

Syntax :- <data type> <array name> [size of row] [size of column]Example :- int a[3][3]



✓ **Multi dimension array (M - D) :-**

- M-D represented by more than 2 brackets at the same time with size.

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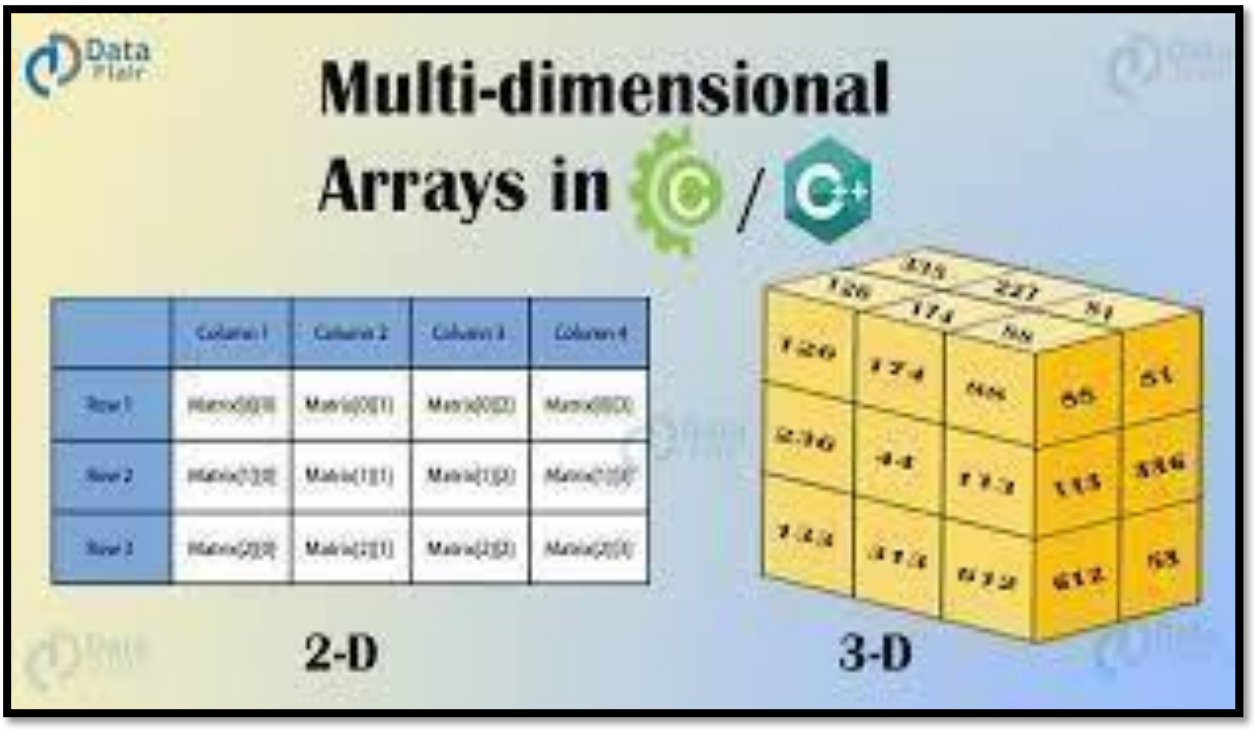
Syntax :- <data type> <array name> (<size 1>) (<size 2>)….(size N)

Example :- int a[3][3][3]



1 Word Question – Answer

	QUESTION	ANSWER
	What is Array?	Group of Elements having same name and type.
2	Array is_____datatype.	Derived
3	Array is used to represent _____	Collection
4	Types of array can be_____& _____	Single/One dimension& Multi/Two dimension

Q-2 Explain Array Initialization in brief.

Detail:

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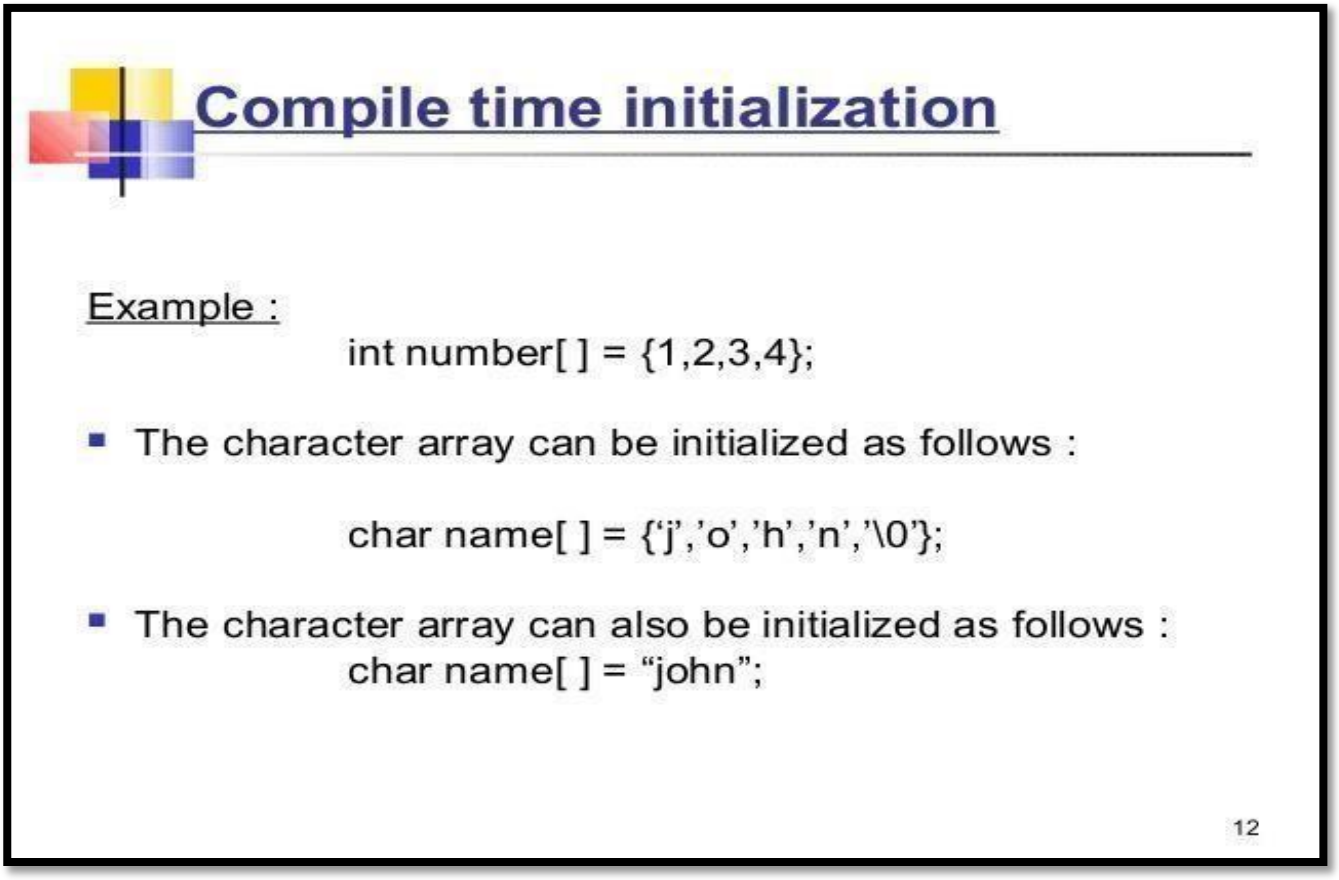
✓ **Initialization of array elements:-**

- After definition and declaration of array now array elements must beinitialized.
- The two-dimensional array can be either initialized at :
  1. Compile time(at the time of declaration)
  2. Run time (using scanf statement or using assignment operator)



1. **Initialization of array at compile time:-**

- In this type of initialization, the array elements can be initialized at thetime of declaration.
- The values are assigned to each array elements enclosed within braces andseparated by comma.

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Example:-

data_type array_name[2] [3]={{1,2,3},{4,5,6}};

column1 column2 column3

1	2	3

2. Initialization of array at run time:-

Run time initialization :

- In run time initialization, the array is explicitly initialize at run time.
- This concept generally used for initializing large arrays.
- Example:

```
for(i=0; i < 100; i++)
{
        if( i < 50)
        sum[i] = 0.0;
        else
        sum[i] = 1.0;
}
```

- Here first 50 elements of the array sum are initialized to 0 and the remaining 50 elements are initialized to 1 at run time.

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- For initialization of two-dimensional array, we need nested for loops.
- The loop with counter i is used for row and the loop with counter j is usedas columns.
- Initially, the value of i=0, which indicates the row 0 and the inner loop reads the values for the elements in each column in the row 0. It continues till the rows complete.
- Firstly declare an array int a[3][3] which will contain total (3*3=9) elements.. Now, using for loop we access the elements of this array as:

```
 for(i-0;i<3;i++)
 {
 for(j=0;j<3;j++)
 {
 printf("\n enter elements a[%d][%d]",i,j);
scanf("%d",&a[i][j]);


}
}
```

- The elements of array will ne initialized using the for loop under:-
- Initially the value of i=0, so the value of a[0] will be scanned first using the scanf statement and likewise the loop executes for values upto a[4].

for loop

j=0 j=1 j=2 j=3

a[0][0] a[0] [1] a[0][2] a[0][3]

1 Word Question – Answer

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SR.NO.	QUESTION	ANSWER
1	If array elements are initialized at the time of declaration then it is called _____ initialization.	Compile time
2	If array elements are initialized at the runtime then it is called_____ initialization.	Runtime
3	In_____array initialization We have to assign fix value or size compulsory.	Compile time
4	Run time initialization of array is suitable for initializing _____array.	Large

Q-3 Explain Array Initialization in brief.

Arrays of Strings

- String is array of characters.
- Thus an array of string is 2-D array of characters.
- E.g.

```
char names[5][10];
```

- Here, names[5][10] means 5 names having 10 characters each.

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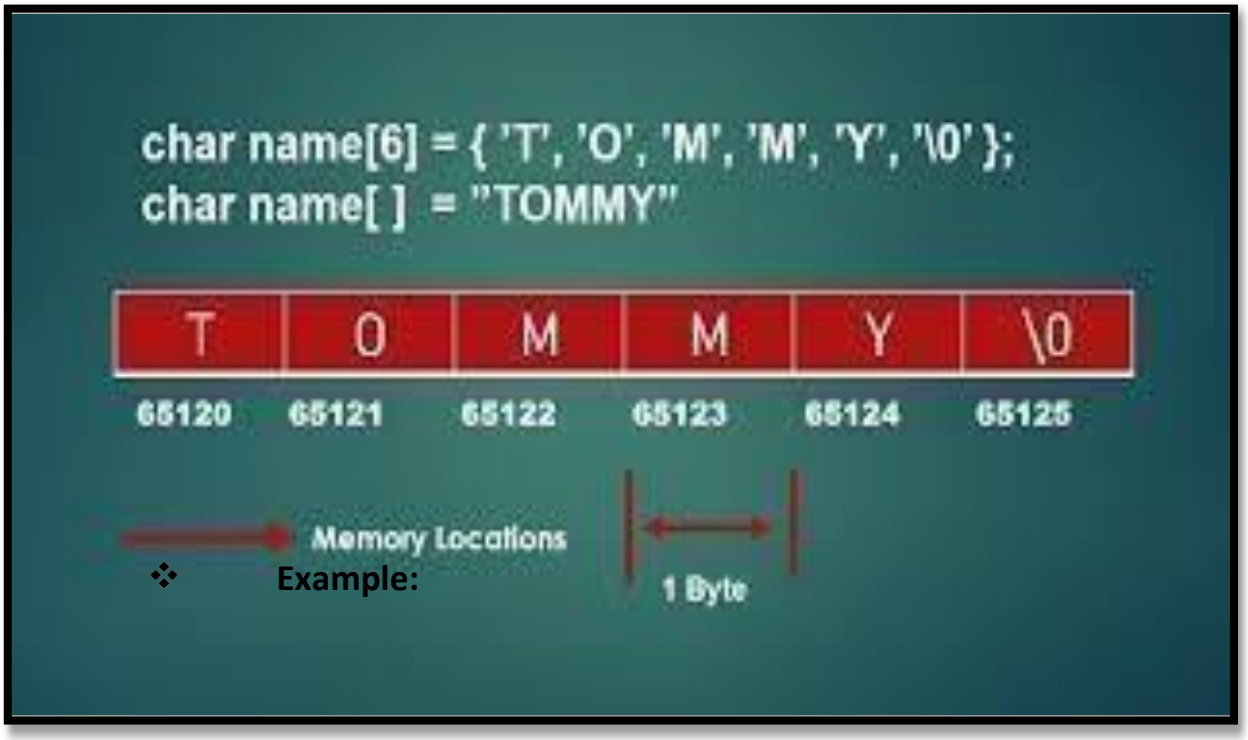
Detail :-

- The array of character is implemented in c which is known as string.
- The declaration of string array or character array can be like :Char str[5] = { ‘a’,’b’,’c’,’d’,’e’,’\0’}
- A NULL char ‘\0’ must be added at the end of array string.
- The character array need one more space to store NULL char.
- C also provide facility to declare character array without specifying number ofelements.
- In this case array size will be declare automatically.

✓ **String Array Memory Allocation :-**



❖ **Example:**

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

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```
void main()
{
      clrscr();
      char arr[3][12]= { "Rose", "India", "technologies" };
      printf("Array of String is = %s,%s,%s\n", arr[0], arr[1], arr[2]);
getch();
}
```

Output:

Array of String is=Rose, India, technologies

1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	String array is_____array of characters	2-D
2	String is array of _____object.	Char
3	Write down statement to declare string array	Char arr[3][12]
4	String array represent_____ and _____.	Array size Total number of characters

Q-4 Explain Array with matrix.

Detail :-

- Array of Array is known as 2 – D array.
- 2-D array in C is also known as Matrix.
- Two dimensional array or multi-dimensional array are used to representdata in matrix form.
- Suppose , We declare array like a[3][3] then Matrix can be store as arraylike following:

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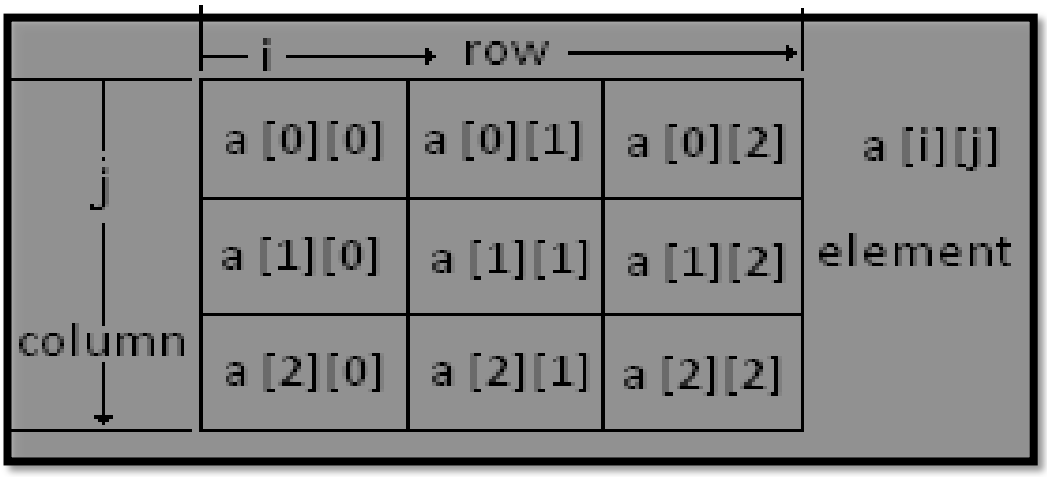

Syntax:

<data-type> <array_nm> [row_subscript][column-subscript];Example:

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

 void main()
 {
            int a[3][3], i, j;
           clrscr();
            printf("\n\t Enter matrix of 3*3 ");

            for(i=0; i<3; i++)
            {
                        for(j=0; j<3; j++)
                        {
                                    scanf("%d",&a[i][j]);  //read 3*3 array
                        }
            }
```

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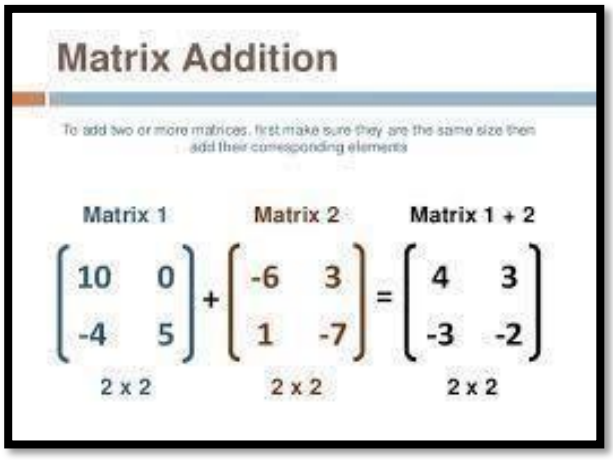
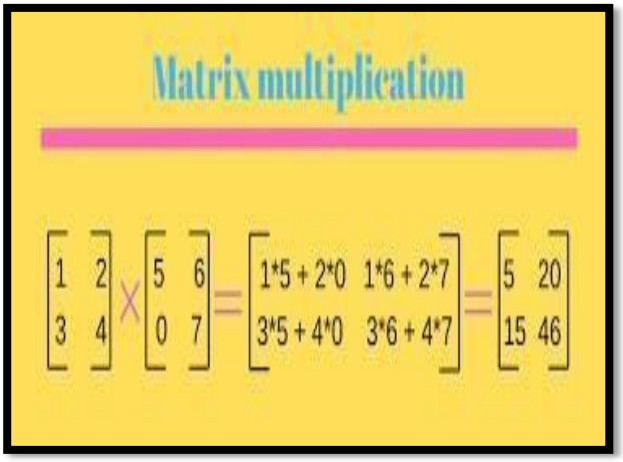
```
 printf("\n\t Matrix is : \n");
for(i=0; i<3; i++)
 {
        for(j=0; j<3; j++)
        {
            printf("\t %d",a[i][j]);  //print 3*3 array
        }
   printf("\n");
   }
   Getch();
   }
```





1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	Matrix can be represented by_____ array.	2-D
2	In Array of Matrix elements can be represented by____and_____.	Rows Columns

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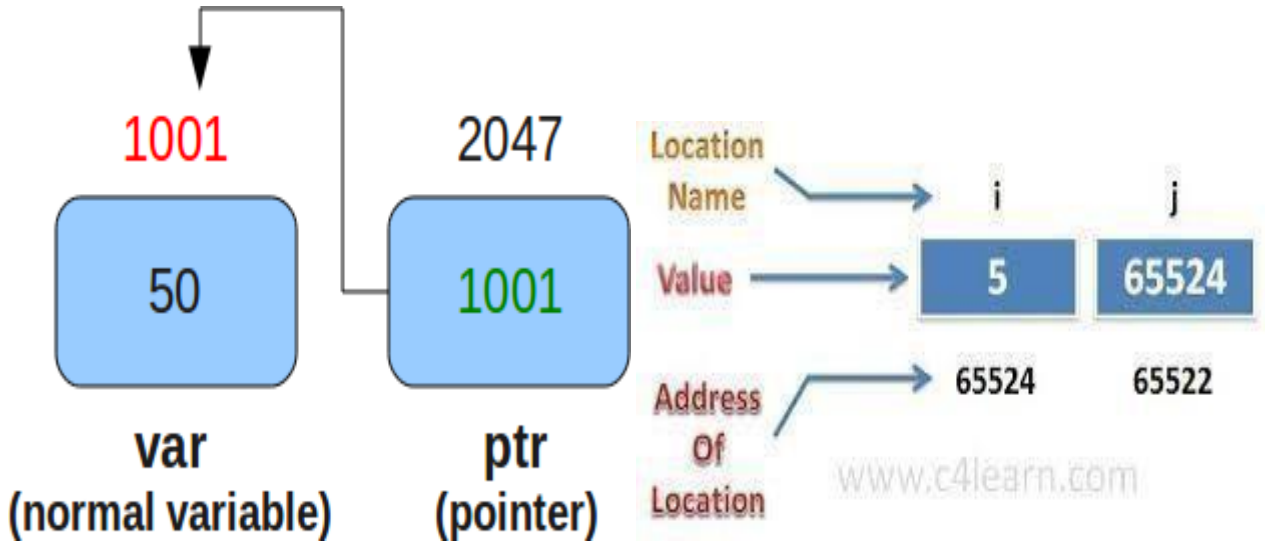
Q-5What is pointer ? How to create pointer?

WHAT IS POINTER?

- A **pointer** is a variable whose value is the address of another variable, i.e., direct address of the memory location. Like any variable or constant, you must declare a pointer before you can use it to store any variable address.
- The general form of a pointer variable declaration is:

dataType *var_name;

- Here,
  - ***dataType*** is the pointer's base type; it must be a valid C data type(i.e., int, float, char etc).
  - **var_name** is the name of the pointer variable.
  - The asterisk * you used to declare a pointer is the same asterisk that you use for multiplication. However, in this statement the asterisk is being used to designate a variable as a pointer.



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Detail :-

- Pointer is the variable that stores the address of another variable.
- Pointer is used to point out memory address.
- The pointer has three main concepts:

1) **Pointer constant:-**
   - In computer memory, memory addresses are known as pointerconstant. One can not change its value, it can only be used.

   Example: *house number*.

2) **Pointer value:-**
   - The pointer value means the *address of another variable.*
   - We can not access the value of memory address directly.
   - If wewant to access then we have to use & operator and * operator

   Example: int a;

   &a is known as pointer value.

3) **Pointer Variable:-**
   - The variable which stores the pointer value is known as pointer variable.

Example

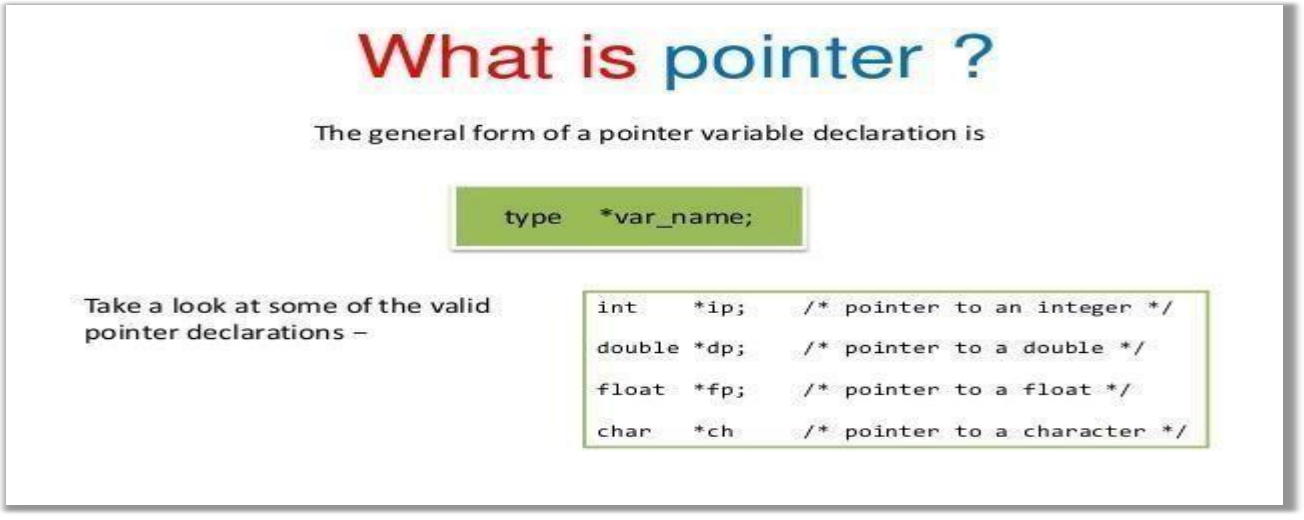
```
#include<stdio.h>
#include<conio.h>

void main()
{
```

```
int a;
int *p;
 clrscr();
p=&a;
printf("\n %u",p); //will print address of a
printf("\n %d",*p); // will print value of a
getch();
}
```

1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	_____is a variable whose value is address of another variable.	pointer
2	Pointer variable can be declare using _____	* (asterisk)
3	The general form of declaring pointer variable is_____	Datatype *<variable name>
4	_____operator is used to store address of any variable	&

Q-6 What is pointer to variable? Explain with Example.



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C Pointer Variables

To declare a pointer variable, we must do two things

- Use the "*" (star) character to indicate that the variable being defined is a pointer type.
- Indicate the type of variable to which the pointer will point (the pointee). This is necessary because C provides operations on pointers (e.g., *, ++, etc) whose meaning depends on the type of the pointee.

- **General declaration of a pointer**

```
type *nameOfPointer;
```

1/14/10

Pointer Declaration

- Type * Varname;
  declares Varname as a pointer to Type
- Examples

```
char* A;
int* B;
struct node * Root;
```

A is a pointer to a character
B is a pointer to an integer
Root is a pointer to a node structure

- * associates with the variable name

```
char *A, B;
```

A is a pointer to a character
B is a character !

Pg. 9

Detail :-

- Variable means you can store particular value.
- Pointer is also one type of variable but the main difference

between simplevariable and pointer variable is that ;

- Simple variable can store only the value.
- Pointer Variable can store address of another variable.

- In short, Pointer to variable means a variable that store pointer value.
- You can declare pointer variable using * (asterisk) and you can store address ofpointer using &(ampersand).

Example:

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

        void main()
        {
                int a=10;
                int *p;
                clrscr();
                p=&a;
                   printf("\n %u",p); //will print address of a
                   printf("\n %d",*p); // will print value of a
                   getch();
          }
```

1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	_____is a variable whose value is address of another variable.	pointer
2	Pointer variable can be declare using _____	* (asterisk)
3	The general form of declaring pointer variable is_____	Datatype *<variable name>
4	_____operator is used to store address of any variable	&

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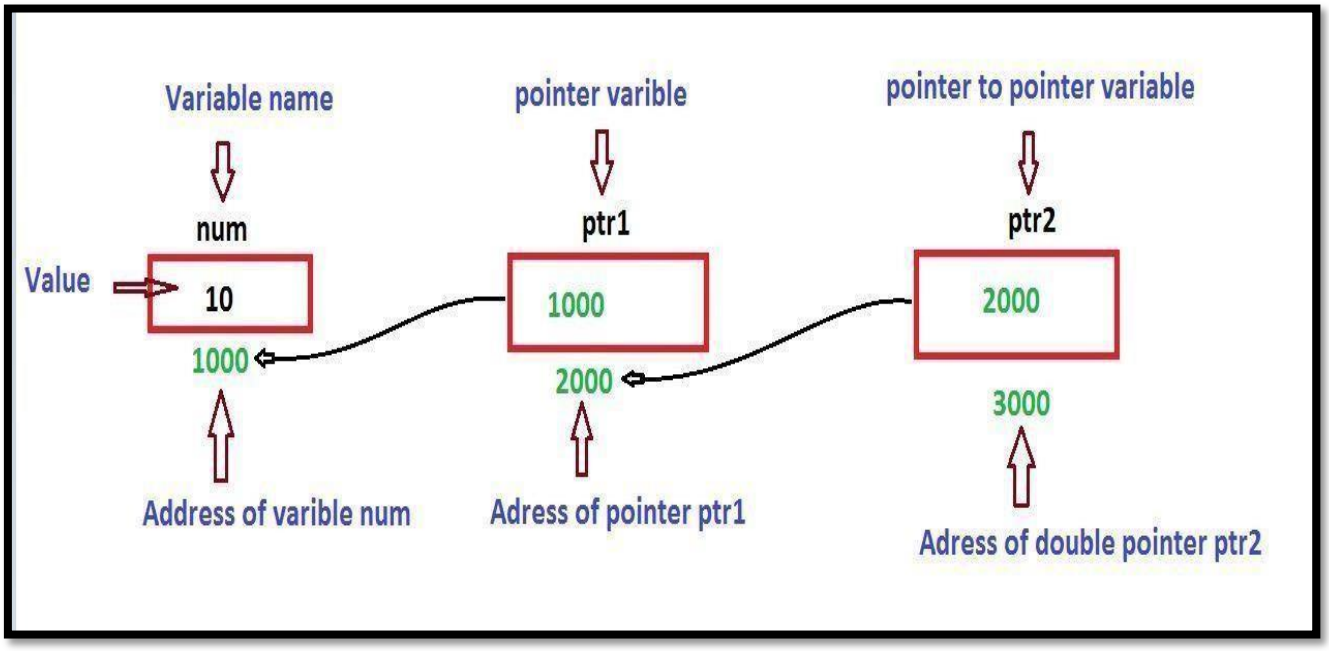
Q-7 What is Pointer to Pointer? Explain with Example.

Detail :-

- In C Programming it is also possible that pointer variable is pointed by anotherpointer variable.
- This process is called pointer to pointer.

Ptr – 2 **ptr -1** **simple variable**



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- Pointer variable ptr-2 having the address of ptr-1 ,same way ptr-1 having the address of simple variable(a).
- This process is known as multiple indirection.
- Pointer to pointer variable must be declare using additional indirection operation(**) in front of variable name like ;

  Int **p;

Example:

```
#include<stdio.h>
#include<conio.h>
void main()
{
        int a=10;
        int *p;
        int **a;
        clrscr();
        p=&a;
        a=&p;
        clrscr();
    printf("\n value of p = %d",*p); //will print address of a
    printf("\n address of p=%d=u",p); // will print value of a
    printf("\n value of a = %d",*p);
    printf("\n value of **a=%d",**a);getch();
}
```

1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	If pointer variable is pointed by another pointer variable then it is called _____	Pointer to pointer

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2	A variable that is pointer to pointer must be declared using_____.	additional indirection (**)
3	_____operator can be used to access members of the structure using pointer.	-> (arrow)
4	The another pointer variable can contains _____of first pointer variable.	address

Q-8 What is Pointer to Array? Explain with Example.

Array of Pointer

```
int a [ ] = {10,20,30,40};

int *p[4];     // *p[0], *p[1], *p[2], *p[3]
```

2886728	2886732	2886736	2886740
10	20	30	40
a[0]	a[1]	a[2]	a[3]

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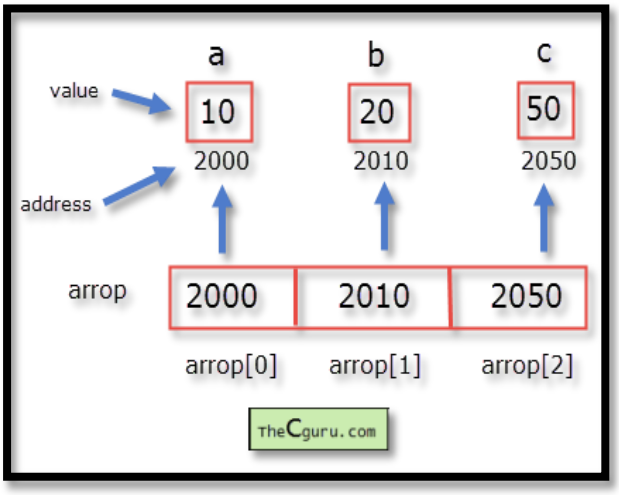

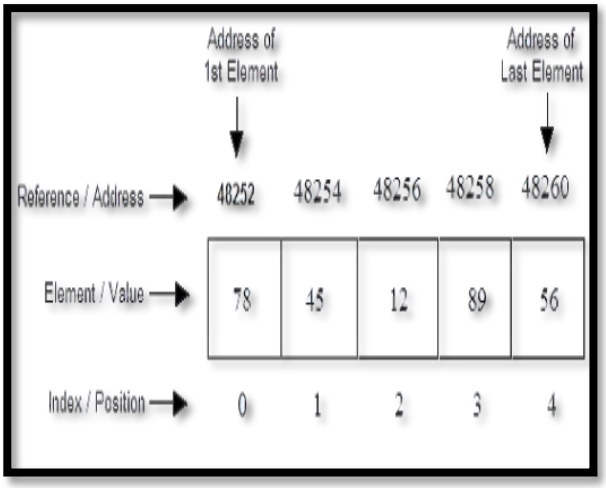

Detail :-

- When array is declared ,compiler decide the memory to store array elements.
- Pointer to array is used to store whole array into single pointer variable.
- We can declare pointer to array like following :

```
Int a[5];
Int *p;
P=a;
P=&a[0];
```

- For Example , you can store each elements of array which can be point out bypointer.
- The array elements using pointer can be store like following ;

Elements	10	20	30	40	50
Array Index	a[0]	a[1]	a[2]	a[3]	a[4]
Pointer	p	p+1	p+2	p+3	p+4

Address	1000	1002	1004	1006	1008

1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	_____is used to point to zero element of the array using pointer.	P=&a[0]
2	If p point to particular element of array then _____ represent next element of array.	P+1

Q-9 What is Pointer to Structure? Explain with Example.

Pointer to Structure

- A structure type pointer variable can be declared as:

```
struct book
        {
        char name[20];
        int pages;
        float price;
        };
struct book *bptr;
```

- However, this declaration for a pointer to structure does not allocate any memory for a structure but allocates only for a pointer, so that to access structure's members through pointer ***bptr***, we must allocate the memory using ***malloc()*** function.
- Now, individual structure members are accessed as:

```
bptr->name      bptr->pages      bptr->price
                   OR
(*bptr).name    (*bptr).pages    (*bptr).price
```

- Here, -> is called arrow operator and there must be a pointer to the structure on the left side of this operator.

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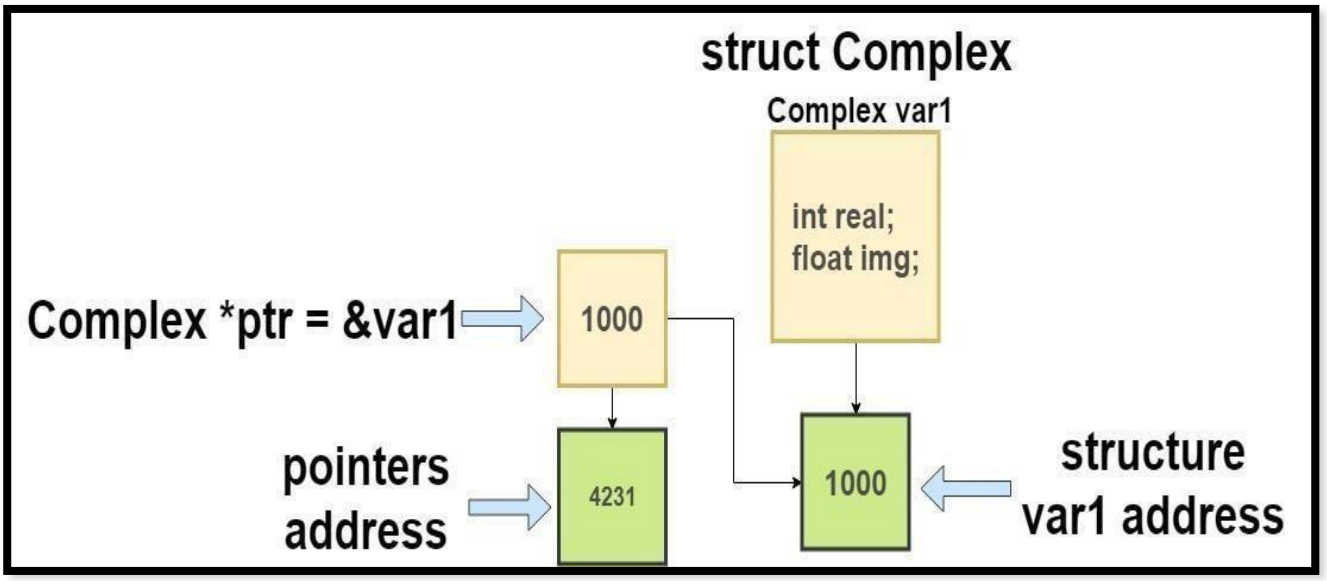

Detail :-

- Structure is a data structure that support group of elements that can be of different data types.
- We can easily use pointer with the structure.
- To access elements of structure (members) ->(arrow) operator can be used.
- Pointer to structure can allocate memory dynamically.
- Pointer must be declare before it is used.

Example:

```
#include<stdio.h>
#include<conio.h>
Struct stud
{
        Int rno;
        Char nm[20];
};
```

```
void main()
{
Struct stud *p;
P=&s;
Clrscr();
s.rno=1;
printf("rno=%d",p->rno);
 getch();
}
```

1 Word Question – Answer

SR.NO.	QUESTION	ANSWER
1	The general form of defining structure to pointer is_____	Struct stud *p
2	Pointer to structure can also allocate memory	Dynamically
3	_____operator can be used to access members of the structure using pointer.	-> (arrow)

Q-10 Explain Memory Allocation of Structure.

Detail :-

- The total memory occupied by structure can be the total size of each member.
- We can also use size of operator to get memory allocation of structure.
- For example : consider that we have following structure:

```
Struct student
    {
        Int rno;
```

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```
    Float salary;
    Char nm[20];
}s;
```

- In above structure it have 3 members:

  Int rno ; - 2 bytes
  Float salary ; - 4 bytes
  Char nm[20] ; - 20 bytes

- Total 26 bytes will be occupied by structure student in the memory.

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SUMMARY QUESTIONS OF CHAPTER -4

ONE - MARK QUESTIONS

- ✓ What is Array?
- ✓ List out Types of Array.
- ✓ How to declare String Array in C?
- ✓ Write down different uses of Array.(OR benefits)
- ✓ What is Pointer ?
- ✓ List out uses of Pointer.(Advantages).
- ✓ Which operator is used to represent Pointer to Pointer.
- ✓ How to Declare Pointer Variable?

TWO - MARK QUESTIONS

- ✓ Explain Two Dimension Array with Example.
- ✓ Explain Array with Structure by Example.
- ✓ Explain Array within Structure by Example.
- ✓ Explain Pointer to Pointer with Example.

THREE - MARK QUESTIONS

- ✓ Explain Array and Matrices with suitabale Example.
- ✓ Write note on Pointer and Structure with Example.
- ✓ Write note on Pointer to Array.

FIVE - MARK QUESTIONS

- ✓ Explain Array with different types.
- ✓ Explain Pointer with reference to Dynamic Programming.
- ✓ Explain Pointer within Array with Example.