SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE NAME : 20CS101-PROGRAMMING FOR PROBLEM SOLVING

I YEAR /I SEMESTER

Unit 3- Arrays and Strings

Topic 3: 2D-Arrays-Initialization - Accessing elements

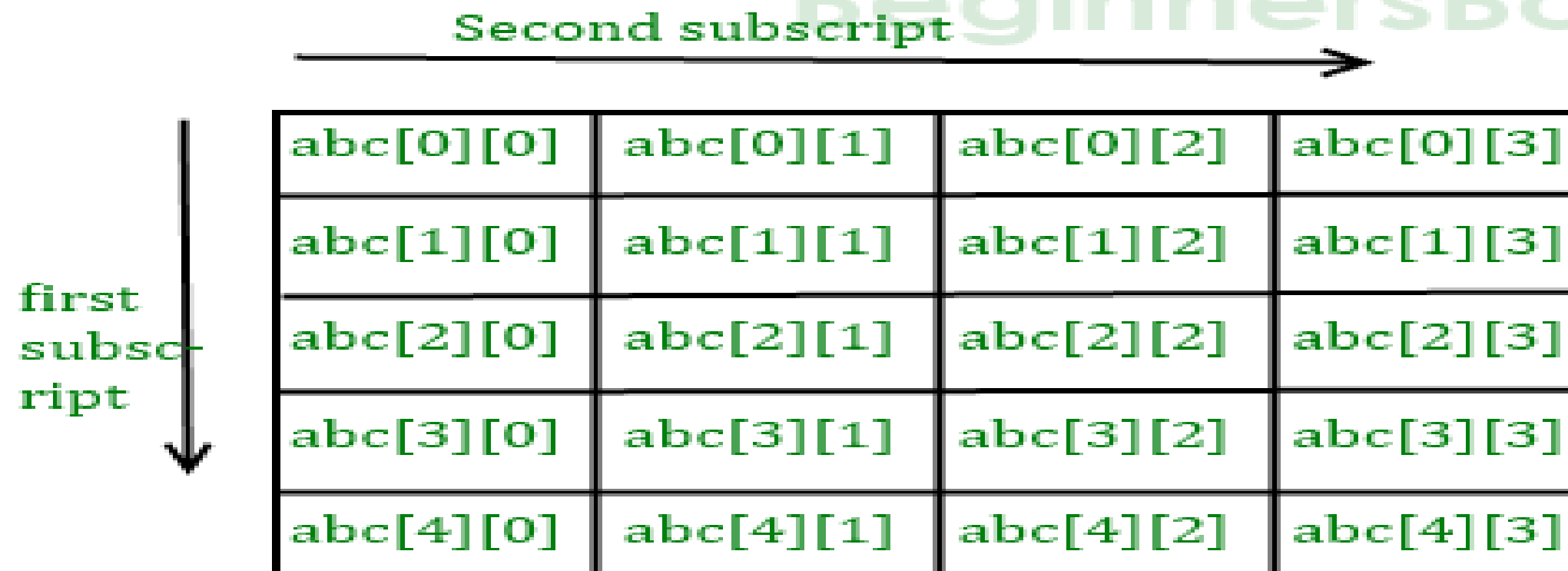# **Brain Storming**

1. How 2D array is created and accessed?

Memory Representation

2D array conceptual memory representation

Second subscript →

first
subsc-
ript

abc[0][0]	abc[0][1]	abc[0][2]	abc[0][3]
abc[1][0]	abc[1][1]	abc[1][2]	abc[1][3]
abc[2][0]	abc[2][1]	abc[2][2]	abc[2][3]
abc[3][0]	abc[3][1]	abc[3][2]	abc[3][3]
abc[4][0]	abc[4][1]	abc[4][2]	abc[4][3]

Here my array is abc[5][4], which can be conceptually viewed as a matrix of 5 rows and 4 columns. Point to note here is that subscript starts with zero, which means abc[0][0] would be the first element of the array.
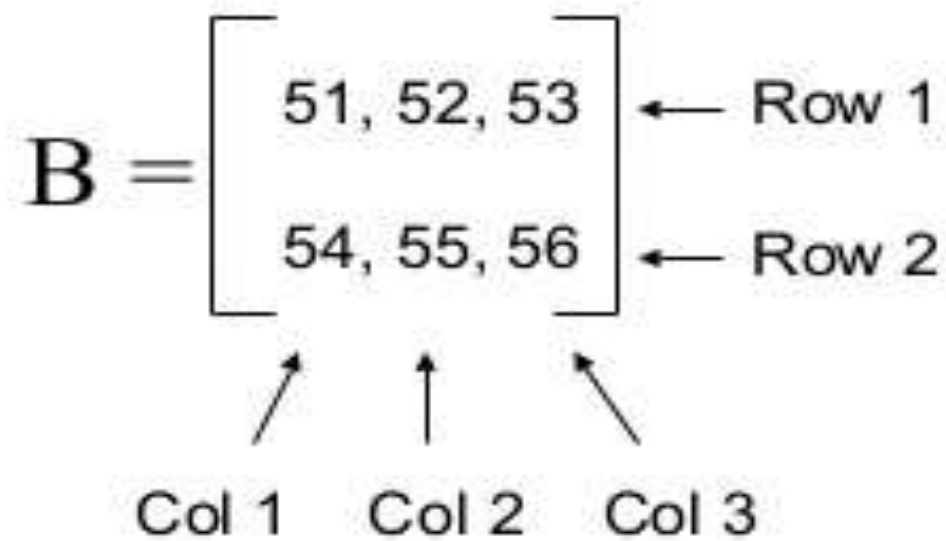
Two Dimensional Array

- The 2D array is organized as matrices which can be represented as the collection of rows and columns.

- **Syntax: data_type array_name[rows][columns];**

- int twodimen[4][3];

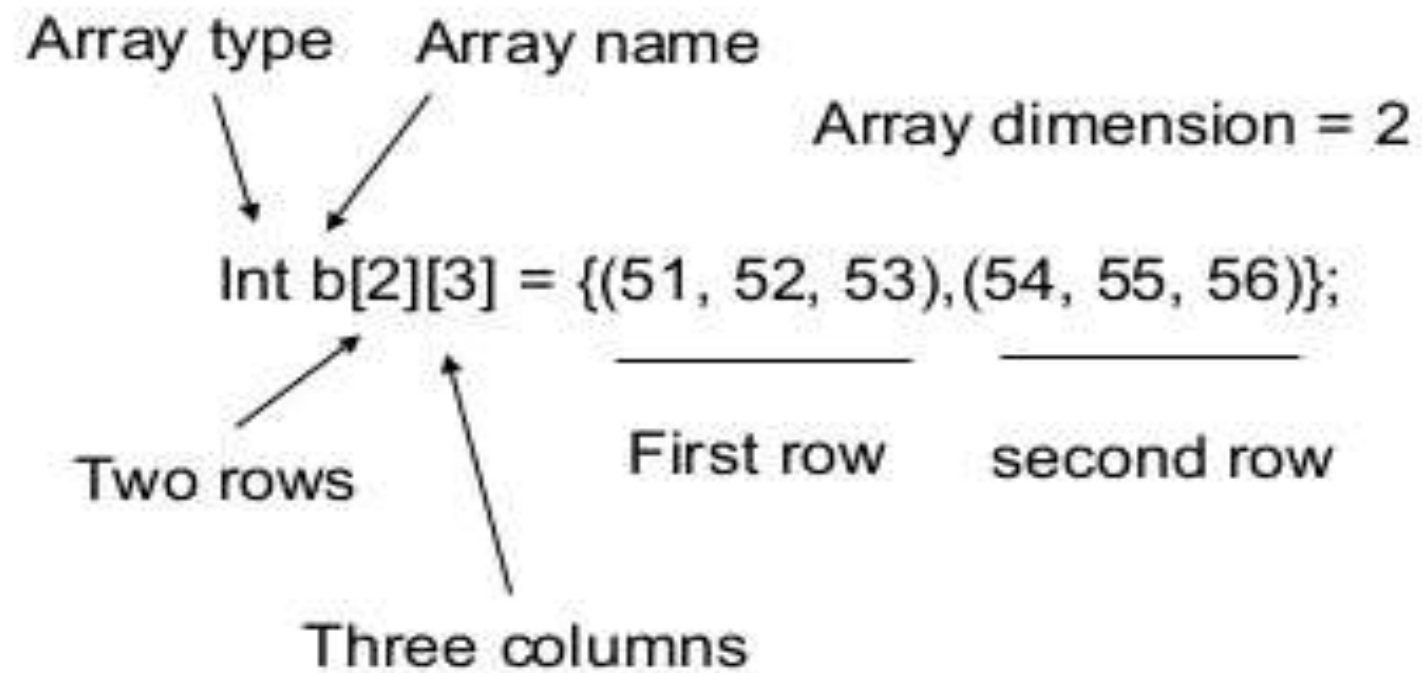- Here, 4 is the number of rows, and 3 is the number of columns.

2D array representation

Two - Dimensional Arrays

- What is a Two-dimensional array?

$$B = \begin{bmatrix} 51, 52, 53 \\ 54, 55, 56 \end{bmatrix} \begin{matrix} \leftarrow \text{Row 1} \\ \leftarrow \text{Row 2} \end{matrix}$$

Col 1   Col 2   Col 3

Algebraic notation

Array type   Array name

Array dimension = 2

Int b[2][3] = {(51, 52, 53),(54, 55, 56)};

Two rows

First row   second row

Three columns

C notation

```
int num[3][4] = {
    {1,  2,  3,  4},
    {5,  6,  7,  8},
    {9, 10, 11, 12}
};
```

col ⟶

row

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

// Different ways to initialize two-dimensional array

int c[2][3] = {{1, 3, 0}, {-1, 5, 9}};

int c[][3] = {{1, 3, 0}, {-1, 5, 9}};

int c[2][3] = {1, 3, 0, -1, 5, 9};
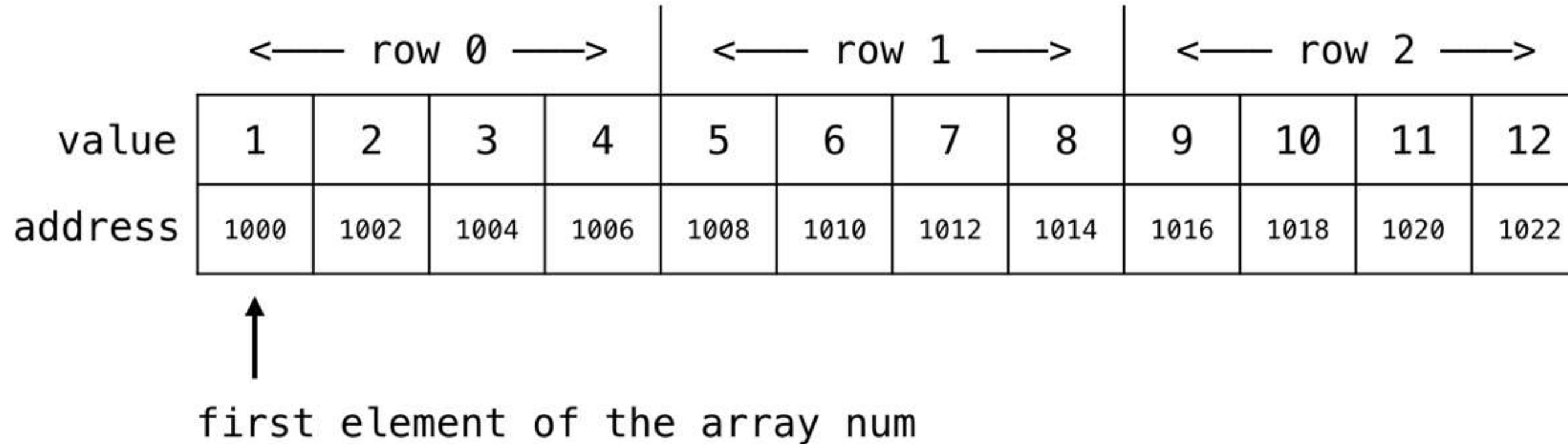
2D array representation

```
int num[3][4] = {
    {1, 2,  3,  4},
    {5, 6,  7,  8},
    {9, 10, 11, 12}
};
```

row-wise memory allocation

<----- row 0 -----> <----- row 1 -----> <----- row 2 ----->

value	1	2	3	4	5	6	7	8	9	10	11	12
address	1000	1002	1004	1006	1008	1010	1012	1014	1016	1018	1020	1022

↑

first element of the array num

Two-dimensional array example in C

```c
#include<stdio.h>
int main(){
int i=0,j=0;
int arr[4][3]={{1,2,3},{2,3,4},{3,4,5},{4,5,6}}
;
//traversing 2D array
for(i=0;i<4;i++){
for(j=0;j<3;j++){
printf("arr[%d] [%d] = %d \n",i,j,arr[i][j]);

}//end of j
}//end of i
return 0;
}
```

Matrix-Addition

Program for addition of two matrices

$$\begin{bmatrix} 0 & 4 \\ 1 & 3 \end{bmatrix} + \begin{bmatrix} 3 & 2 \\ 5 & 1 \end{bmatrix} \rightarrow \begin{bmatrix} 0+3 & 4+2 \\ 1+5 & 3+1 \end{bmatrix} \rightarrow \begin{bmatrix} 3 & 6 \\ 6 & 4 \end{bmatrix}$$

```c
// C program to find the sum of two matrices of order 2*2

#include <stdio.h>
void main()
{
  float a[2][2], b[2][2], result[2][2];

  // Taking input using nested for loop
  printf("Enter elements of 1st matrix\n");
  for (int i = 0; i < 2; ++i)
    for (int j = 0; j < 2; ++j)
    {
      printf("Enter a%d%d: ", i + 1, j + 1);
      scanf("%f", &a[i][j]);
    }

  // Taking input using nested for loop
  printf("Enter elements of 2nd matrix\n");
  for (int i = 0; i < 2; ++i)
    for (int j = 0; j < 2; ++j)
    {
      printf("Enter b%d%d: ", i + 1, j + 1);
      scanf("%f", &b[i][j]);
    }

  // adding corresponding elements of two arrays
  for (int i = 0; i < 2; ++i)
    for (int j = 0; j < 2; ++j)
    {
      result[i][j] = a[i][j] + b[i][j];
    }

  // Displaying the sum
  printf("\nSum Of Matrix:");

  for (int i = 0; i < 2; ++i)
    for (int j = 0; j < 2; ++j)
    {
      printf("%.1f\t", result[i][j]);

      if (j == 1)
        printf("\n");
    }
}
```

Run Code
Output:

Enter elements of 1st matrix
Enter a11: 2;
Enter a12: 0.5;
Enter a21: -1.1;
Enter a22: 2;
Enter elements of 2nd matrix
Enter b11: 0.2;
Enter b12: 0;
Enter b21: 0.23;
Enter b22: 23;

Sum Of Matrix:
2.2   0.5
-0.9   25.0

C Program-Matrix Addition

```c
#include<stdio.h>

int main()
{
    int a[5][5],b[5][5],c[5][5],i,j,m,n;
    printf("How many rows and columns?");
    scanf("%d%d",&m,&n);
    printf("\nEnter first matrix:\n");

    for(i=0;i<m;++i)
        for(j=0;j<n;++j)
            scanf("%d",&a[i][j]);

    printf("\nEnter second matrix:\n");

    for(i=0;i<m;++i)
        for(j=0;j<n;++j)
            scanf("%d",&b[i][j]);

    printf("\nMatrix after addition:\n");

    for(i=0;i<m;++i)
    {
        for(j=0;j<n;++j)
        {
            c[i][j]=a[i][j]+b[i][j];
            printf("%d ",c[i][j]);
        }

        printf("\n");
    }

    return 0;
}
```

Conti...

Output

How many rows and columns?3
3

Enter first matrix:
2 6 9
3 2 0
2 4 1

Enter second matrix:
3 4 1
6 7 9
11 3 5

Matrix after addition:
5 10 10
9 9 9
13 7 6

Assessment 1

1. What is 2D array?

Ans : _____

2. Write C program for storing and retrieving data from 2D array ?

Ans : _____

References

TEXT BOOKS

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Thank You