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Experiment No.	5

AIM:	Demonstrate the use of two-dimensional arrays to solve a given problem.
Program 1	
PROBLEM STATEMENT :	Write a program to perform Matrix Addition, Subtraction.
ALGORITHM:	1. Start 2. Define a void function read with the arguments : dimensions m and n of a 2D array ,array. A. Declare variables i and j. B. Iterate i from 0 to m and iterate j from 0 to n,incrementing i and j by 1 each iteration: - - Read the value of arr[i][j] using scanf. 3. Define the function print with the arguments : dimensions m and n of a 2D array and the array itself. - a. Declare variables i and j. - b. Iterate i from 0 to m and iterate j from 0 to n,incrementing i and j by 1 each iteration: - - Print the value of arr[i][j] \t - print a new line 4. Define a void function addMatrice with the arguments : dimensions m and n of two arrays and their elements, result array. A. Declare variables i and j. B. Iterate i from 0 to and iterate j from 0 to n,incrementing i and j by 1 each iteration: - - Calculate the sum of corresponding elements of arr1 and arr2 and store it in res[i][j]. C. Print "result: ". D. Call the print function with parameters m, n, and res.

```
5. Define a void function subtractMatrix with the arguments : dimensions m and n
   of two arrays and their elements, result array.
      A. Declare variables i and j.
      B. Iterate i from 0 to m and iterate j from 0 to n,incrementing i and j by 1
         each iteration:
           - - Calculate the difference of corresponding elements of arr1 and arr2
         and store it in res[i][j].
      C. Print "result: ".
      D. Call the print function with parameters m, n, and res.

6. Define the main function.
      A. Declare integer variables m, n, and choice.
      B. Print "rows: " and read the value of m using scanf.
      C. Print "columns: " and read the value of n using scanf.
      D. Declare 2D arrays arr1, arr2, and res, each with dimensions m x n.
      E. Print "Enter elements first:" and call the read function with parameters
         m, n, and arr1.
      F. Print "Enter elements second:" and call the read function with
         parameters m, n, and arr2.
      G. Print "First matrix is:" and call the print function with parameters m, n,
         and arr1.
      H. Print "Second matrix is:" and call the print function with parameters
         m, n, and arr2.
      I. Print the menu options for addition and subtraction.
      J. Read the value of choice using scanf.
      K. Using a switch-case statement, perform the chosen operation based on
         the user's choice.
            ● Case 1 :

                  1. Print “addition of matrix is:”
                  2. call the addMatrice function with parameters m,
                     n,arr1,arr2 and res.

            ● Case 2:

                  1. Print “subtraction of matrix is:”
                  2. call the subtractMatrix function with parameters m,
                     n,arr1,arr2 and res.
```

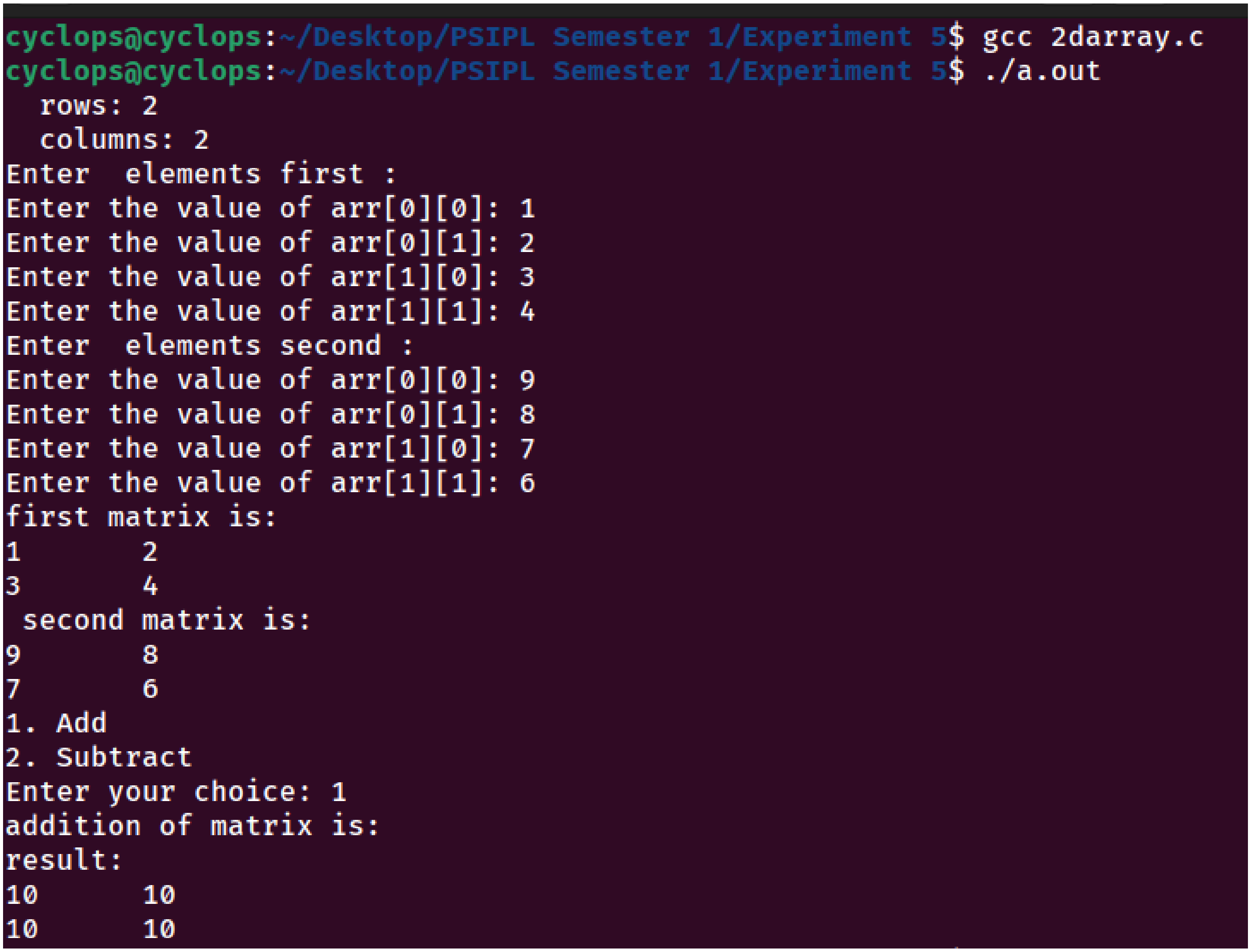
```
        ● Default case :
            1. Print "Invalid choice".

7. End.
```

PROGRAM:

```c
#include <stdio.h>

void read (int m,int n, int arr[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            printf("Enter the value of arr[%d][%d]: ",i,j);
            scanf("%d",&arr[i][j]);
        }
    }
}
void print(int m,int n, int arr[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            printf("%d\t",arr[i][j]);
        }
        printf("\n");
    }
}

void addMatrice(int m, int n ,int arr1[m][n],int arr2[m][n],int res[m][n])
```

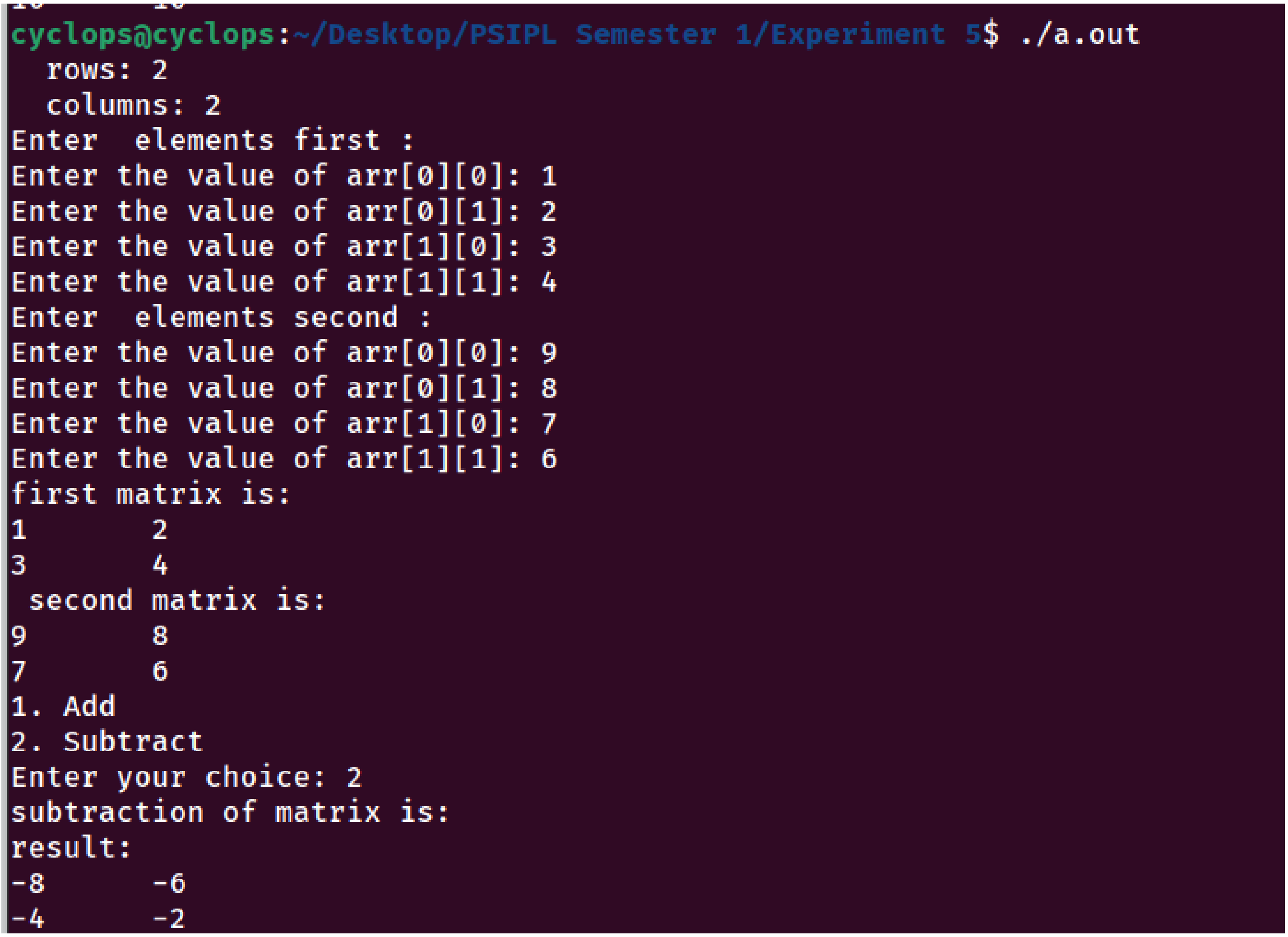
```
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            res[i][j]=arr1[i][j]+arr2[i][j];
        }
    }
    printf("result: \n");
    print(m,n,res);
}

void subtractMatrix(int m, int n ,int arr1[m][n],int
arr2[m][n],int res[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            res[i][j]=arr1[i][j]-arr2[i][j];
        }
    }
    printf("result: \n");
    print(m,n,res);
}

int main()
{
    int m,n;
    printf("  rows: ");
    scanf("%d",&m);
    printf("  columns: ");
    scanf("%d",&n);
    int arr1[m][n],arr2[m][n],res[m][n];
    printf("Enter  elements first : \n");
    read(m,n,arr1);
    printf("Enter  elements second : \n");
    read(m,n,arr2);
    printf("first matrix is: \n");
    print(m,n,arr1);
    printf(" second matrix is: \n");
    print(m,n,arr2);
    printf("1. Add\n2. Subtract\n");
    printf("Enter your choice: ");
    int choice;
    scanf("%d",&choice);
    switch(choice)
    {
        case 1: printf("addition of matrix is: \n");
                addMatrice(m,n,arr1,arr2,res);
                break;
        case 2:printf("subtraction of matrix is: \n");
                subtractMatrix(m,n,arr1,arr2,res);
                break;
        default: printf("Invalid choice");
    }

    return 0;
}
```

RESULT:
Addition :



```
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ gcc 2darray.c
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ ./a.out
  rows: 2
  columns: 2
Enter  elements first :
Enter the value of arr[0][0]: 1
Enter the value of arr[0][1]: 2
Enter the value of arr[1][0]: 3
Enter the value of arr[1][1]: 4
Enter  elements second :
Enter the value of arr[0][0]: 9
Enter the value of arr[0][1]: 8
Enter the value of arr[1][0]: 7
Enter the value of arr[1][1]: 6
first matrix is:
1       2
3       4
 second matrix is:
9       8
7       6
1. Add
2. Subtract
Enter your choice: 1
addition of matrix is:
result:
10      10
10      10
```

Subtraction:



```
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ ./a.out
  rows: 2
  columns: 2
Enter  elements first :
Enter the value of arr[0][0]: 1
Enter the value of arr[0][1]: 2
Enter the value of arr[1][0]: 3
Enter the value of arr[1][1]: 4
Enter  elements second :
Enter the value of arr[0][0]: 9
Enter the value of arr[0][1]: 8
Enter the value of arr[1][0]: 7
Enter the value of arr[1][1]: 6
first matrix is:
1       2
3       4
 second matrix is:
9       8
7       6
1. Add
2. Subtract
Enter your choice: 2
subtraction of matrix is:
result:
-8      -6
-4      -2
```

Program 2	
PROBLEM STATEMENT :	Write a program to perform Matrix Multiplication

ALGORITHM:

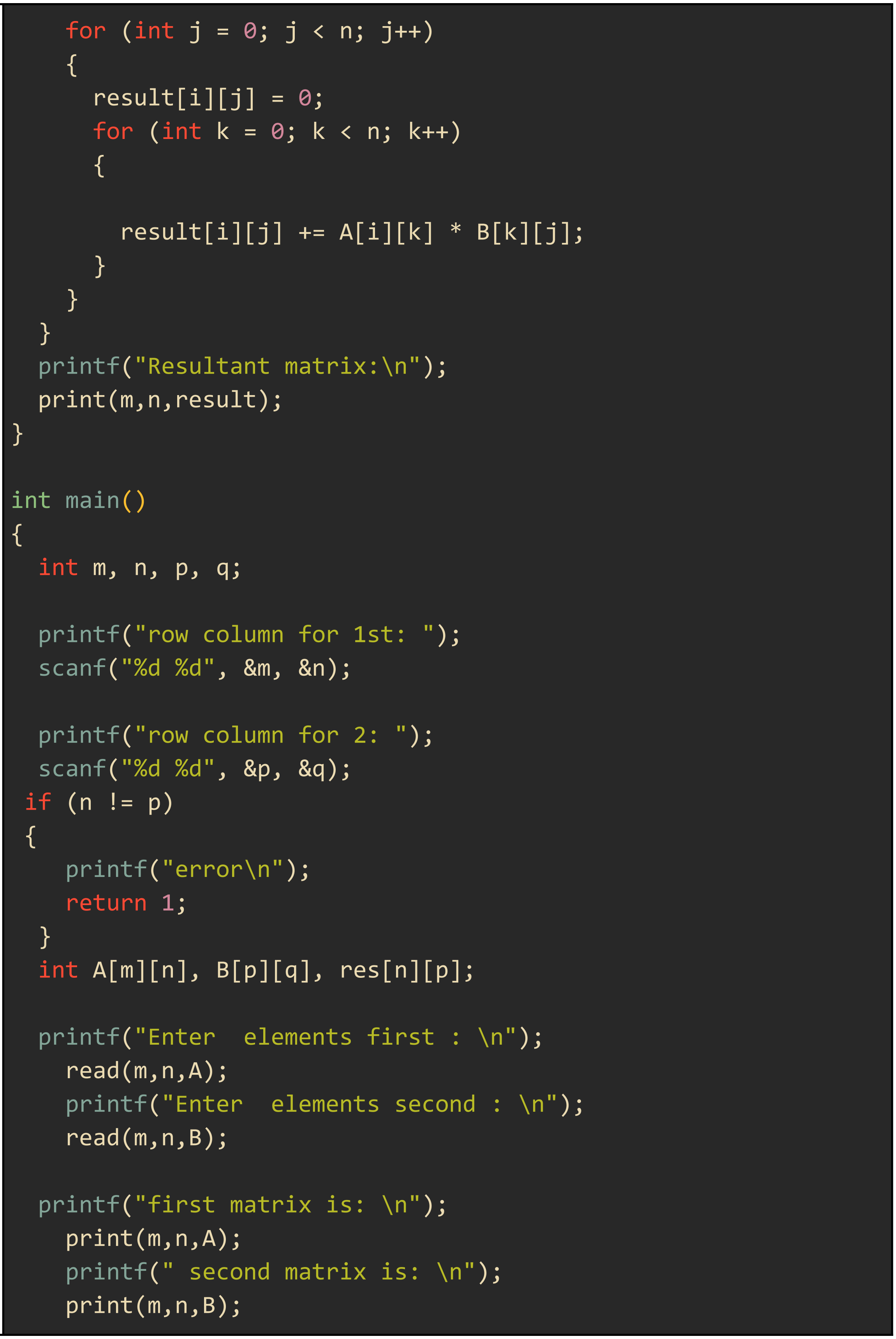
```
1. Start

2. Define a void function read with the arguments : dimensions m and n of a 2D array , array.
     A.  Declare variables i and j.
     B.  Iterate i from 0 to m and iterate j from 0 to n,incrementing i and j by 1 each iteration:
           - - Read the value of arr[i][j] using scanf.

3. Define the function print with the arguments : dimensions m and n of a 2D array ,array.
     A.  Declare variables i and j.
     B.  Iterate i from 0 to m and iterate j from 0 to n,incrementing i and j by 1 each iteration:
           - - Print the value of arr[i][j] followed by a tab.
            - print a newline.

4. Define a void function multiplyMatrices with the arguments : dimensions m, n, p, and q of two 2D arrays and their elements, result array.
     A.  Iterate i from 0 to m,incrementing i by 1 each iteration:
     B.  Iterate j from 0 to n ,incrementing j by 1 each iteration:
             - - result[i][j] =0.
             - - Iterate k from 0 to n,incrementing k by1 each iteration:
                 - - Update result[i][j] by adding the product of A[i][k] and B[k][j].
     C.  Print "Resultant matrix:".
     D.  Call the print function with parameters m, n, and result.

5. Define the main function.
     A.  Declare integer variables m, n, p, and q.
     B.  Print "row column for 1st:" and read the values of m and n using scanf.
     C.  Print "row column for 2:" and read the values of p and q using scanf.
     D.  If the number of columns in the first matrix is not equal to the number of rows in the second matrix:
             - - Print "error"
     E.  Declare 2D arrays A, B, and res, each with dimensions m x n, p x q, and n x p, respectively.
     F.  Print "Enter elements first:" and call the read function with parameters m, n, and A.
     G.  Print "Enter elements second:" and call the read function with parameters p, q, and B.
     H.  Print "First matrix is:" and call the print function with parameters m, n, and A.
     I.  Print "Second matrix is:" and call the print function with parameters p, q, and B.
```

J. Call the multiplyMatrices function with parameters m, n, p, q, A, B, and res.

6. End.

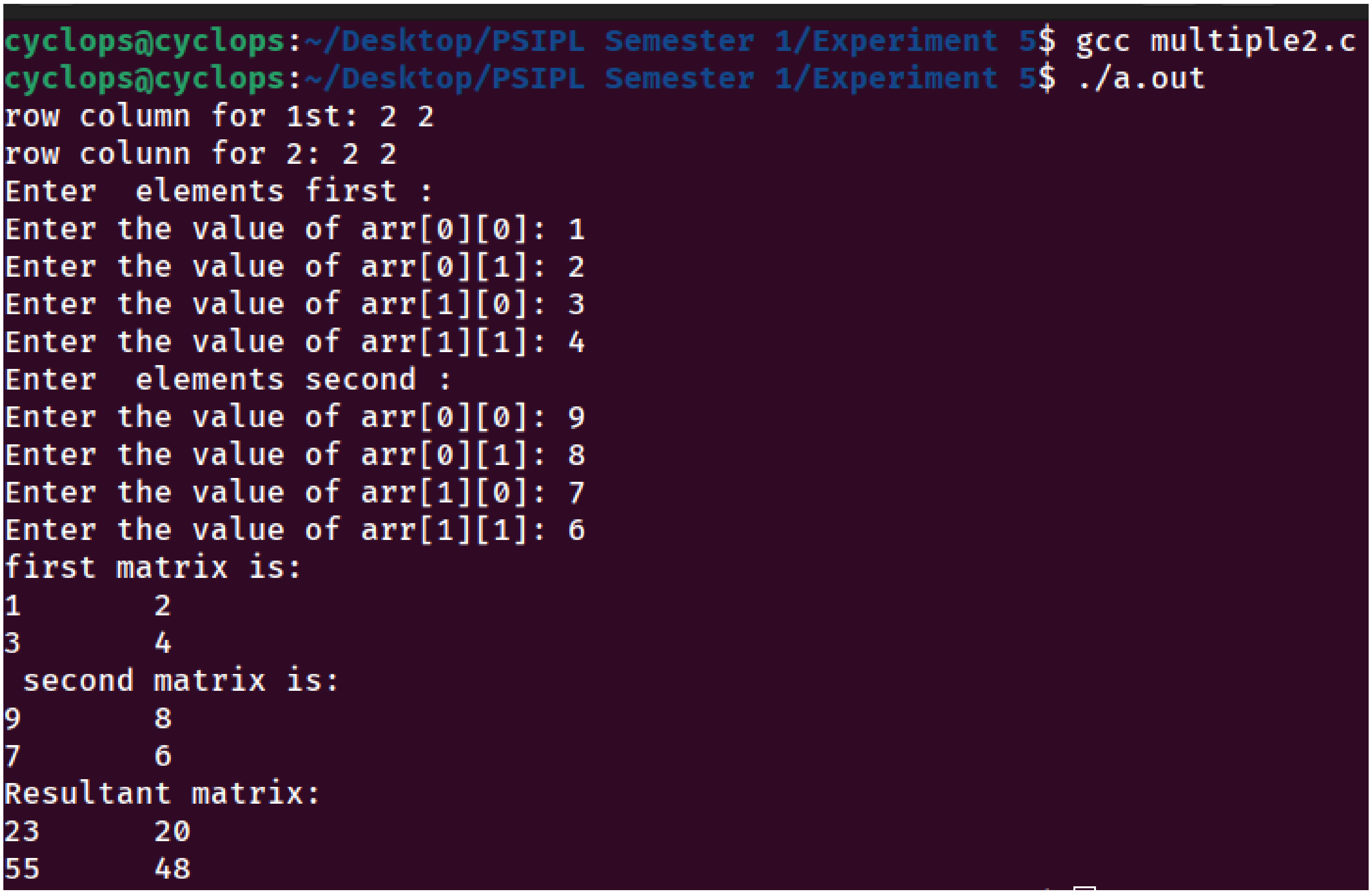
PROGRAM:

```
#include <stdio.h>


void read (int m,int n, int arr[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            printf("Enter the value of arr[%d][%d]: ",i,j);
            scanf("%d",&arr[i][j]);
        }
    }
}
void print(int m,int n, int arr[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            printf("%d\t",arr[i][j]);
        }
        printf("\n");
    }
}

void multiplyMatrices( int m, int n, int p,int q,int A[m][n],
int B[p][q], int result[n][p])
{
  for (int i = 0; i < m; i++)
  {
```

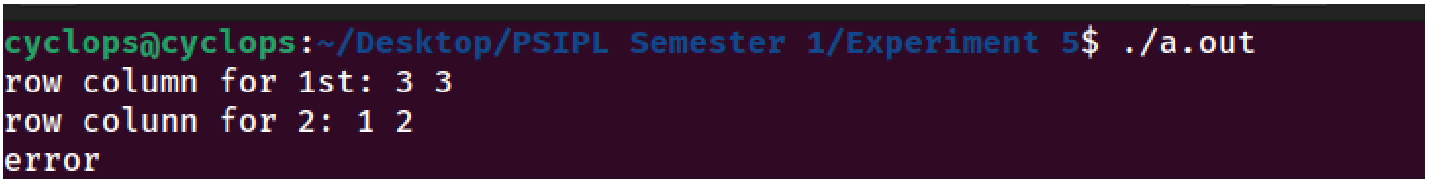


```
    for (int j = 0; j < n; j++)
    {
      result[i][j] = 0;
      for (int k = 0; k < n; k++)
      {

        result[i][j] += A[i][k] * B[k][j];
      }
    }
  }
  printf("Resultant matrix:\n");
  print(m,n,result);
}

int main()
{
  int m, n, p, q;

  printf("row column for 1st: ");
  scanf("%d %d", &m, &n);

  printf("row column for 2: ");
  scanf("%d %d", &p, &q);
 if (n != p)
 {
    printf("error\n");
    return 1;
  }
  int A[m][n], B[p][q], res[n][p];

  printf("Enter  elements first : \n");
    read(m,n,A);
    printf("Enter  elements second : \n");
    read(m,n,B);

  printf("first matrix is: \n");
    print(m,n,A);
    printf(" second matrix is: \n");
    print(m,n,B);
  multiplyMatrices(m,n,p,q,A,B,res);

   return 0;
}
```

RESULT:



```
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ gcc multiple2.c
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ ./a.out
row column for 1st: 2 2
row colunn for 2: 2 2
Enter  elements first :
Enter the value of arr[0][0]: 1
Enter the value of arr[0][1]: 2
Enter the value of arr[1][0]: 3
Enter the value of arr[1][1]: 4
Enter  elements second :
Enter the value of arr[0][0]: 9
Enter the value of arr[0][1]: 8
Enter the value of arr[1][0]: 7
Enter the value of arr[1][1]: 6
first matrix is:
1       2
3       4
 second matrix is:
9       8
7       6
Resultant matrix:
23      20
55      48
```



```
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ ./a.out
row column for 1st: 3 3
row colunn for 2: 1 2
error
```

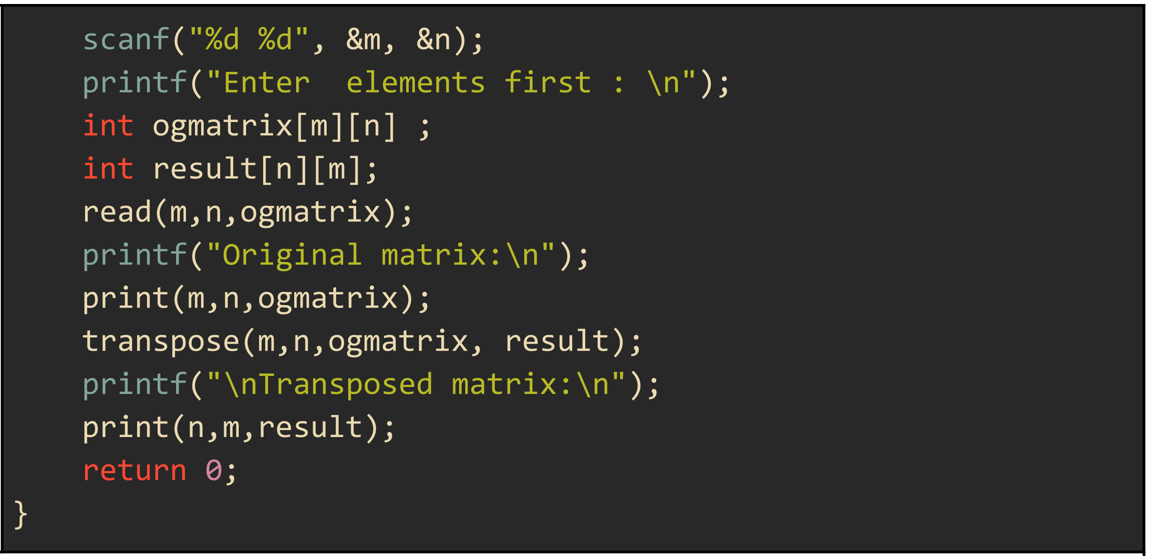
Program 3

PROBLEM STATEMENT :	Write a program to perform Transpose of Matrix
ALGORITHM:	1) Start 2) Define a void function read with arguments : dimensions m and n of 2D array , array.

```
        A.   Declare i and j.
        B.   Iterate i from 0 to m and iterate j from 0 to n,incrementing i and j by 1
             each iteration:
               - -Read the value of arr[i][j] using scanf.

3)  Define a void function transpose with arguments : dimensions m and n of a
    matrix, original matrix, result matrix.
        A.  Iterate i from 0 to m,incrementing i by 1 each iteration:
       - - Iterate j from 0 to n,incrementing j and j by 1 each iteration:
        - - Assign the value of matrix[i][j] to result[j][i].

4)  4. Define a void function print with arguments : the dimensions m and n of a
    2D array ,array.
        A.   Declare i and j.
        B.   Iterate i from 0 to m and iterate j from 0 to n,,incrementing i and j by
             1 each iteration:
                - - Print the value of arr[i][j] \t
                - print a newline.

5)  Define the main function.
        A.   Declare integer    m and n.
        B.   Read the values of m and n using scanf.
        C.   Declare 2D arrays ogmatrix and result with dimensions m x n and n x
             m respectively.

        D.   Call the read function with parameters m, n, and ogmatrix.
        E.   Print "Original matrix:".
        F.   Call the print function with parameters m, n, and ogmatrix.
        G.   Call the transpose function with parameters m, n, ogmatrix, and result.
        H.   Print "Transposed matrix:".
        I.   Call the print function with parameters n, m, and result.
6)  End.
```

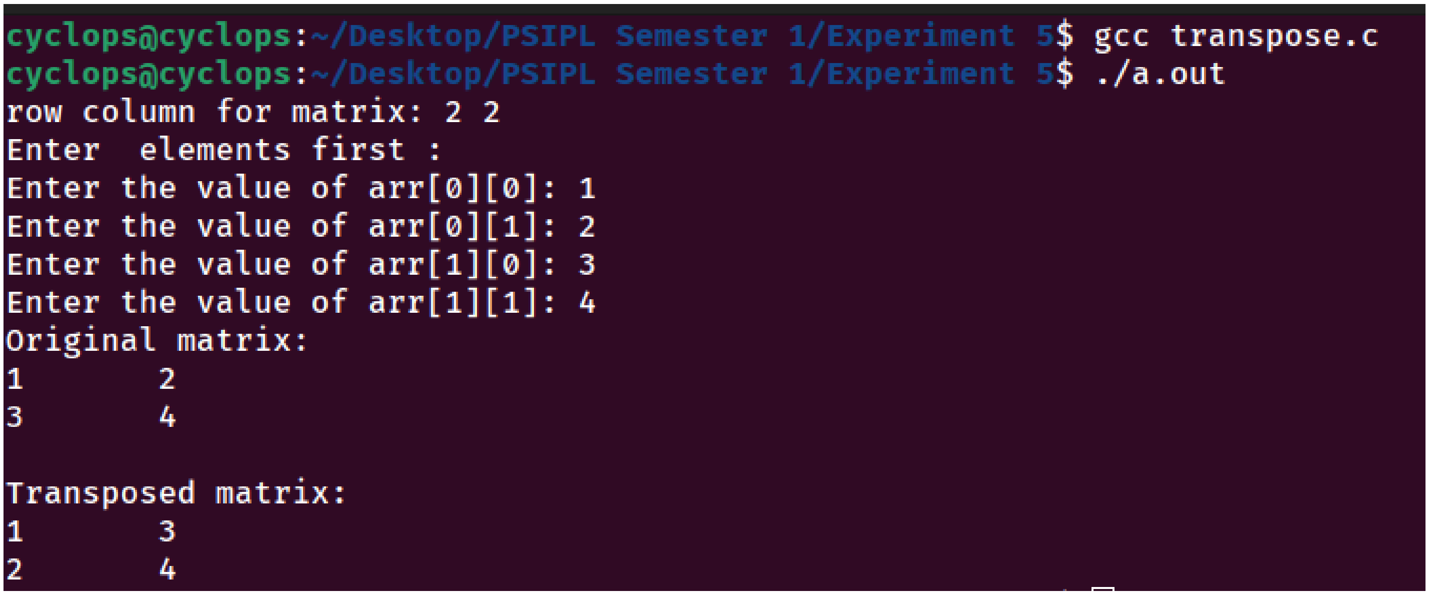
PROGRAM:

```
#include <stdio.h>

void read (int m,int n, int arr[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            printf("Enter the value of arr[%d][%d]: ",i,j);
            scanf("%d",&arr[i][j]);
        }
    }
}

void transpose(int m,int n,int matrix[m][n], int result[n][m])
{
    for (int i = 0; i < m; i++)
    {
        for (int j = 0; j < n; j++)
        {
            result[j][i] = matrix[i][j];
        }
    }
}

void print(int m,int n, int arr[m][n])
{
    int i,j;
    for (i=0;i<m;i++)
    {
        for (j=0;j<n;j++)
        {
            printf("%d\t",arr[i][j]);
        }
        printf("\n");
    }
}

int main()
{
    int m, n;
    printf("row column for matrix: ");
```



```c
    scanf("%d %d", &m, &n);
    printf("Enter  elements first : \n");
    int ogmatrix[m][n] ;
    int result[n][m];
    read(m,n,ogmatrix);
    printf("Original matrix:\n");
    print(m,n,ogmatrix);
    transpose(m,n,ogmatrix, result);
    printf("\nTransposed matrix:\n");
    print(n,m,result);
    return 0;
}
```

RESULT:



```
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ gcc transpose.c
cyclops@cyclops:~/Desktop/PSIPL Semester 1/Experiment 5$ ./a.out
row column for matrix: 2 2
Enter  elements first :
Enter the value of arr[0][0]: 1
Enter the value of arr[0][1]: 2
Enter the value of arr[1][0]: 3
Enter the value of arr[1][1]: 4
Original matrix:
1       2
3       4

Transposed matrix:
1       3
2       4
```

CONCLUSION:	**I have understood how to use two-dimensional arrays to solve a given problem.**