Exercise Problems - 7

Two-dimensional arrays

1. An outline of a program to tranform an $n \times n$ square matrix into its transpose is given below. Complete the missing parts. Do not declare any other variables in your program.

```
#include<stdio.h>
int main()
{
  int i, j, a[10][10], n, t;
  printf("Give dimension (<=10) \n");
  scanf("%d", &n);
  if(n<=10)
  {  printf("enter elements of a %d X %d matrix\n", n, n);
     for(i=0; i<n; i++)
        for(j=0; j<n; j++)
        {
           scanf("%d", &a[i][j]);
        }

     for(i=0; i<n; i++)
        for(j=______; j<n; j++)
        {
           ---------------

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        }

      printf("transpose is \n");
      for(i=0; i<n; i++)
      {
        for(j=0; j<n; j++)
        {
           printf("%2d ", a[i][j]);
        }

        --------------------
      }
  }
  return 0;
}
```

2. Write a program that takes elements of a two-dimensional array $a[4][4]$ as input from the user and tranform a by rotating the columns of a downwards so that after the tranformation, column 0 of a is replaced by the original column 3 of a, column 1 of a is replaced by the original column 0 of a, column 2 of a is replaced by the original column 1 of a and column 3 of a is replaced by the original column 2 of a. Print the two-dimensional array a after the transformation. Avoid using more than one two-dimensional array in your program.

3. Write a program that takes elements of a square matrix M of dimension $5X5$ as input and does the following:

   (a) If the element $M[0][0]$ is t, where $t \neq 0$, then compute a matrix M' such that for each $1 \leq i \leq 5$, Row_i of M' = Row_i of M - ($\frac{1}{t}$ Row_0 of M).

   (b) If the element $M[0][0]$ is 0, then print a message that the operation cannot be performed.

4. Write a program that takes the number of rows of a square matrix M and the elements of M as input an performs the following task:

   (a) Compute and print the index of the row of M with the maximum absolute value for its entry in column 0 (assuming that the index starts from 0). If there is more than one row satisfying the above condition, compute the minimum index among all such rows.

   (b) If i is the row index obtained in the previous step, compute the matrix M' obtained by exchanging row 0 and row i of M. Print M'.

   (c) If the maximum absolute value in column 0 of M is 0, print a message that M is singular.

5. Write a program that takes the number of rows and number of columns of two matrices A and B along with the elements of these two matrices as input from the user and checks if the dimensions of A and B are suitable for computing the matrix product $A \times B$. If yes, compute the matrix product $C = A \times B$ and print the matrix C.