DSA Practical Exam - 1 [2D Arrays]

1. **Q1: Diagonal Sum of a Matrix**
   You are given a 4x4 matrix representing scores in a tournament. The user inputs the values of the matrix. Write the steps to calculate the sum of the elements on the primary diagonal (top-left to bottom-right) and the secondary diagonal (top-right to bottom-left).

   Example Input:
   ```
   10 20 30 40
   50 60 70 80
   90 100 110 120
   130 140 150 160
   ```
   Expected Output:
   Primary diagonal sum: 340
   Secondary diagonal sum: 340

2. **Q2: Maximum Element in Each Row**
   Write steps to input a 2D array of size 5x5 representing student grades. After inputting the values, find and display the maximum grade in each row.

   Example Input:
   ```
   45 67 88 92 76
   55 78 81 89 90
   70 75 86 91 80
   60 72 83 84 88
   50 68 87 82 85
   ```
   Expected Output:
   Row 1 max: 92
   Row 2 max: 90
   Row 3 max: 91
   Row 4 max: 88
   Row 5 max: 87

3. **Q3: Rotating a 2D Array 90 Degrees**
   A user inputs a 3x3 matrix. Write the steps to rotate the matrix 90 degrees clockwise and display the output.

   Example Input:
   ```
   1 2 3
   4 5 6
   7 8 9
   ```
   Expected Output (after rotation):
   ```
   7 4 1
   8 5 2
   9 6 3
   ```

4. **Q4: Counting Even and Odd Elements in a 2D Array**
   You are given a 3x3 matrix with random numbers. Write the steps to count how many even and odd numbers exist in the matrix.

   Example Input:
   ```
   12 23 34
   45 56 67
   78 89 90
   ```
   Expected Output:
   Even numbers count: 5
   Odd numbers count: 4

5. **Q5: Row-wise Sorting**
   Write the steps to sort each row of a 4x4 matrix in ascending order. The user enters the matrix, and the output should display the matrix with sorted rows.

   Example Input:
   ```
   4 3 2 1
   16 15 14 13
   9 8 7 6
   5 12 11 10
   ```
   Expected Output:
   ```
   1 2 3 4
   13 14 15 16
   6 7 8 9
   5 10 11 12
   ```

6. **Q6: Boundary Elements Sum**
   A 5x5 matrix is provided by the user. Calculate the sum of all the boundary elements (elements in the first row, last row, first column, and last column).

   Example Input:
   ```
   1 2 3 4 5
   6 7 8 9 10
   11 12 13 14 15
   16 17 18 19 20
   21 22 23 24 25
   ```
   Expected Output:
   Boundary sum: 225

7. **Q7: Counting Zeros in a 2D Array**
   Write a process where the user inputs a 4x4 matrix. Count how many zero elements exist in the matrix and display the result.

   Example Input:
   ```
   1 0 3 4
   0 5 0 7
   8 0 0 2
   3 9 1 0
   ```
   Expected Output:
   Number of zeros: 6

8. **Q8: Transpose of a Matrix**
   A user enters a 3x3 matrix. Write the steps to find the transpose of the matrix (switch rows and columns) and display the result.

   Example Input:
   ```
   1 2 3
   4 5 6
   7 8 9
   ```
   Expected Output:
   ```
   1 4 7
   2 5 8
   3 6 9
   ```

9. **Q9: Frequency of Elements in a 2D Array**
   Write steps to count the frequency of each element in a 2D array of size 4x4. If an element appears multiple times, display how many times it appears.

   Example Input:
   ```
   1 2 3 4
   2 3 4 1
   3 4 1 2
   4 1 2 3
   ```
   Expected Output:
   Frequency of 1: 4
   Frequency of 2: 4
   Frequency of 3: 4
   Frequency of 4: 4

10. **Q10: Matrix Border Product**
   A user inputs a 4x4 matrix. Write steps to calculate the product of all the elements in the border of the matrix (first row, last row, first column, last column). Display the result.

   Example Input:
   ```
   1 2 3 4
   5 6 7 8
   9 10 11 12
   13 14 15 16
   ```
   Expected Output:
   Border product: 1 * 2 * 3 * 4 * 8 * 12 * 16 * 15 * 14 * 13 * 9 * 5 = 139345920