



Day 15: 2D List

1. Column-wise Sum (Basic)

Write a Python function that takes a 2D list (matrix) and returns a list of the sum of each column's elements.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 9]  
]
```

Expected Output:

```
[12, 15, 18]
```

2. Row-wise Maximum

Write a function that returns the maximum element of each row in a 2D list.

Input Example:

```
matrix = [  
    [10, 20, 30],  
    [5, 7, 8],  
    [2, 1, 9]  
]
```

Expected Output:

```
[30, 8, 9]
```

3. Transpose of a Matrix

Write a function that returns the transpose of a 2D list (matrix).

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 9]  
]
```

Expected Output:

```
[  
    [1, 4, 7],  
    [2, 5, 8],  
    [3, 6, 9]  
]
```

4. Matrix Diagonal Sum

Create a function that calculates the sum of the diagonal elements of a square 2D list.

Input Example:

```
matrix = [  
    [1, 2, 3],
```

```
[4, 5, 6],  
[7, 8, 9]  
]
```

Expected Output:

```
15 # (1 + 5 + 9)
```

5. Flatten a Matrix

Write a function that flattens a 2D list into a 1D list.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 9]  
]
```

Expected Output:

```
[1, 2, 3, 4, 5, 6, 7, 8, 9]
```

6. Find the Minimum Element in a Matrix

Create a function that finds the minimum element in the entire 2D list.

Input Example:

```
matrix = [  
    [11, 22, 33],  
    [14, 15, 6],  
    [7, 18, 19]  
]
```

Expected Output:

```
6
```

7. Zig-Zag Traversal of Matrix

Write a function that prints the elements of a matrix in a zig-zag pattern, starting from the top-left corner.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 9]  
]
```

Expected Output:

```
[1, 2, 3, 6, 5, 4, 7, 8, 9]
```

8. Row-wise Reversal

Create a function that reverses each row of the given 2D list.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 9]  
]
```

Expected Output:

```
[  
    [3, 2, 1],  
    [6, 5, 4],  
    [9, 8, 7]  
]
```

9. Check if Two Matrices are Equal

Write a function that checks if two given 2D lists are equal.

Input Example:

```
matrix1 = [  
    [1, 2, 3],  
    [4, 5, 6]  
]  
  
matrix2 = [  
    [1, 2, 3],  
    [4, 5, 6]  
]
```

Expected Output:

```
True
```

10. Matrix Multiplication

Write a function that multiplies two matrices and returns the result as a 2D list.

Input Example:

```
matrix1 = [  
    [1, 2],  
    [3, 4]  
]  
  
matrix2 = [  
    [5, 6],  
    [7, 8]  
]
```

Expected Output:

```
[  
    [19, 22],  
    [43, 50]  
]
```

11. Count Occurrences of a Value

Write a Python function that takes a 2D list and a target value, and returns the count of how many times the value occurs in the 2D list.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 1]  
]  
target = 1
```

Expected Output:

```
2
```

12. Sum of Row-wise Minimum Elements

Write a function that calculates the sum of the minimum element from each row of the 2D list.

Input Example:

```
matrix = [  
    [10, 20, 30],  
    [5, 15, 25],  
    [7, 8, 9]  
]
```

Expected Output:

```
22  # (10 + 5 + 7)
```

13. Find the Second Largest Element

Write a function that finds the second largest element in a 2D list.

Input Example:

```
matrix = [  
    [10, 20, 30],  
    [15, 25, 35],  
    [5, 8, 12]  
]
```

Expected Output:

```
30
```

14. Rotate Matrix by 90 Degrees (Clockwise)

Create a function that rotates a given 2D list by 90 degrees clockwise.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
    [7, 8, 9]  
]
```

Expected Output:

```
[  
    [7, 4, 1],  
    [8, 5, 2],  
    [9, 6, 3]  
]
```

15. Replace Negative Numbers with Zero

Write a function that replaces all negative numbers in a 2D list with zero.

Input Example:

```
matrix = [  
    [1, -2, 3],  
    [-4, 5, -6],  
]
```

```
[7, -8, 9]  
]
```

Expected Output:

```
[  
  [1, 0, 3],  
  [0, 5, 0],  
  [7, 0, 9]  
]
```

16. Calculate the Trace of a Matrix

The trace of a matrix is the sum of the diagonal elements (top-left to bottom-right). Write a function to calculate the trace.

Input Example:

```
matrix = [  
  [1, 2, 3],  
  [4, 5, 6],  
  [7, 8, 9]  
]
```

Expected Output:

```
15 # (1 + 5 + 9)
```

17. Check Symmetric Matrix

Write a function that checks if a square matrix is symmetric. A matrix is symmetric if it's equal to its transpose.

Input Example:

```
matrix = [  
  [1, 2, 3],  
  [2, 4, 5],  
]
```



```
[3, 5, 6]  
]
```

Expected Output:

```
True
```

18. Element-wise Matrix Addition

Write a function to perform element-wise addition of two matrices and return the result.

Input Example:

```
matrix1 = [  
    [1, 2],  
    [3, 4]  
]  
matrix2 = [  
    [5, 6],  
    [7, 8]  
]
```

Expected Output:

```
[  
    [6, 8],  
    [10, 12]  
]
```

19. Spiral Order Traversal

Write a function to print the elements of a 2D list in spiral order.

Input Example:

```
matrix = [  
    [1, 2, 3],  
    [4, 5, 6],  
]
```

```
[7, 8, 9]  
]
```

Expected Output:

```
[1, 2, 3, 6, 9, 8, 7, 4, 5]
```

20. Boundary Elements of a Matrix

Write a function that returns only the boundary elements of a 2D matrix, excluding the inner elements.

Input Example:

```
matrix = [  
    [1, 2, 3, 4],  
    [5, 6, 7, 8],  
    [9, 10, 11, 12],  
    [13, 14, 15, 16]  
]
```

Expected Output:

```
[1, 2, 3, 4, 8, 12, 16, 15, 14, 13, 9, 5]
```