1D Arrays (Linear Arrays)

1. **Sum of Array Elements**
   - Write a program that takes an integer array as input and returns the sum of all its elements.
   - **Example**: For an array `[1, 2, 3, 4, 5]`, the output should be `15`.
2. **Find Maximum Element in Array**
   - Write a function that finds and returns the maximum element in an integer array.
   - **Example**: For an array `[3, 5, 7, 2, 8]`, the output should be `8`.
3. **Reverse an Array**
   - Write a method that reverses the elements of a given integer array.
   - **Example**: For an array `[1, 2, 3, 4, 5]`, the output should be `[5, 4, 3, 2, 1]`.
4. **Count Occurrences of an Element**
   - Write a program that takes an integer array and an integer value as input and returns the count of occurrences of that value in the array.
   - **Example**: For an array `[1, 2, 3, 2, 4, 2]` and value `2`, the output should be `3`.
5. **Check if Array is Sorted**
   - Write a function that checks if a given array is sorted in ascending order.
   - **Example**: For an array `[1, 2, 3, 4, 5]`, the output should be `true`. For `[1, 3, 2]`, the output should be `false`.
6. **Remove Duplicates from Array**
   - Write a program to remove duplicate elements from an integer array and print the unique elements.
   - **Example**: For an array `[1, 2, 2, 3, 4, 4, 5]`, the output should be `[1, 2, 3, 4, 5]`.
7. **Shift Array Elements to the Right**
   - Write a program that takes an array and shifts each element to the right by one position, with the last element moving to the first position.
   - **Example**: For `[1, 2, 3, 4, 5]`, the output should be `[5, 1, 2, 3, 4]`.
8. **Find Pairs with Given Sum**
   - Write a function to find all pairs in an array that sum up to a given number.
   - **Example**: For `[1, 2, 3, 4, 5]` and sum `5`, the output should be pairs `(1, 4)` and `(2, 3)`.
9. **Find the Second Largest Element**
   - Write a program that finds the second largest element in an integer array.
   - **Example**: For `[3, 5, 7, 2, 8]`, the output should be `7`.
10. **Move Zeros to the End**
    - Write a function that moves all zeros in an array to the end while maintaining the order of non-zero elements

- **Example**: For `[0, 1, 0, 3, 12]`, the output should be `[1, 3, 12, 0, 0]`.

2D Arrays (Matrix)

1. **Sum of Elements in 2D Array**
   - Write a program to calculate the sum of all elements in a 2D integer array.
   - **Example**: For a 2D array `{{1, 2}, {3, 4}}`, the output should be `10`.
2. **Transpose of a Matrix**
   - Write a function that takes a 2D array (matrix) as input and returns its transpose.
   - **Example**: For `{{1, 2}, {3, 4}}`, the output should be `{{1, 3}, {2, 4}}`.
3. **Row-wise Sum of 2D Array**
   - Write a program that calculates the sum of elements in each row of a 2D array and prints it.
   - **Example**: For `{{1, 2, 3}, {4, 5, 6}}`, the output should be `6` for the first row and `15` for the second.
4. **Check if Matrix is Symmetric**
   - Write a function that checks if a given square matrix is symmetric (i.e., the matrix is equal to its transpose).
   - **Example**: For `{{1, 2, 3}, {2, 1, 4}, {3, 4, 1}}`, the output should be `true`.
5. **Diagonal Sum of Square Matrix**
   - Write a program to find the sum of the diagonal elements of a square matrix.
   - **Example**: For `{{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}`, the output should be `15` (sum of 1, 5, and 9).
6. **Rotate Matrix by 90 Degrees**
   - Write a function to rotate a given 2D matrix by 90 degrees clockwise.
   - **Example**: For `{{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}`, the output should be `{{7, 4, 1}, {8, 5, 2}, {9, 6, 3}}`.
7. **Sum of Each Column in a 2D Array**
   - Write a program to calculate the sum of elements in each column of a 2D array and print it.
   - **Example**: For `{{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}`, the output should be `12`, `15`, and `18` for each column.
8. **Find Saddle Point in Matrix**
   - A saddle point in a matrix is an element that is the smallest in its row but the largest in its column. Write a program to find all saddle points in a 2D matrix.
   - **Example**: For `{{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}`, there may or may not be a saddle point depending on the matrix.

9. **Sort Each Row of a 2D Array**
    - Write a program to sort each row of a 2D array in ascending order.
    - **Example**: For `{{3, 2, 1}, {6, 5, 4}, {9, 8, 7}}`, the output should be `{{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}`.

3D Arrays

1. **Sum of All Elements in a 3D Array**
    - Write a program to calculate the sum of all elements in a 3D integer array.
    - **Example**: For a 3D array `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}`, the output should be `36`.
2. **Count Negative Numbers in 3D Array**
    - Write a function that counts the total number of negative elements in a 3D integer array.
    - **Example**: For `{{{-1, 2}, {3, -4}}, {{5, -6}, {-7, 8}}}`, the output should be `4`.
3. **Find Maximum Element in 3D Array**
    - Write a program that finds and returns the maximum element in a 3D integer array.
    - **Example**: For `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}`, the output should be `8`.
4. **Check if All Elements in a Layer are Positive**
    - Write a function that checks if all elements in a specific layer of a 3D array are positive. The function should take the 3D array and layer index as inputs.
    - **Example**: For array `{{{1, 2}, {3, 4}}, {{5, -6}, {7, 8}}}`, checking the second layer should return `false`.
5. **Count Layers with Sum Greater than a Given Value**
    - Write a function that counts the number of layers in a 3D array where the sum of elements in each layer is greater than a specified value.
    - **Example**: For array `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}` and value `10`, the output should be `2`.
6. **Flatten a 3D Array into 1D**
    - Write a program that converts a 3D array into a 1D array, keeping the elements in the same order.
    - **Example**: For `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}`, the output should be `[1, 2, 3, 4, 5, 6, 7, 8]`.
7. **Find Average of Each Layer in 3D Array**
    - Write a program to find the average of elements in each layer of a 3D array and print it.

    - **Example**: For `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}`, the output should be `2.5` for the first layer and `6.5` for the second layer.
8. **Find Minimum Element in Each Layer**
    - Write a function to find and return the minimum element in each layer of a 3D array.
    - **Example**: For `{{{3, 4}, {2, 1}}, {{6, 7}, {8, 5}}}`, the output should be `1` for the first layer and `5` for the second layer.
9. **Sum of Diagonal Elements in 3D Cubic Array**
    - Write a program to calculate the sum of diagonal elements of each 2D matrix in a 3D cubic array (only if the layers are square matrices).
    - **Example**: For `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}`, the output should be `5` for the first layer and `13` for the second.
10. **Find Specific Value in 3D Array**
    - Write a function that checks if a specific integer exists in a 3D array and returns its coordinates (layer, row, and column).
    - **Example**: For `{{{1, 2}, {3, 4}}, {{5, 6}, {7, 8}}}` and value `6`, the output should be `(1, 1, 1)` (layer 1, row 1, column 1).