Abstraction Problem Scenarios

Problem 1: **Find the Median of Two Sorted Arrays**

Given two sorted arrays, find the median of the two sorted arrays. The median is the middle value when the arrays are combined and sorted. If the total number of elements is even, the median is the average of the two middle values.

Input:

- Array 1: [1, 3]
- Array 2: [2]

Output:

- Median: 2

Problem 2: **Find the Maximum Subarray Sum (Kadane's Algorithm)**

Given an integer array, find the sum of the contiguous subarray with the largest sum.

Input:

- Array: [-2, 1, -3, 4, -1, 2, 1, -5, 4]

Output:

- Maximum Sum: 6 (Subarray: [4, -1, 2, 1])

Problem 3: **Merge Two Sorted Arrays**

You are given two sorted arrays, and you need to merge them into one sorted array.

Input:

- Array 1: [1, 3, 5, 7]
- Array 2: [2, 4, 6, 8]

Output:

- Merged Array: [1, 2, 3, 4, 5, 6, 7, 8]

Problem 4: **Find the Kth Largest Element in an Array**

Given an unsorted array of integers, find the Kth largest element in the array.

Input:

- Array: [3, 2, 1, 5, 6, 4]
- K = 2

Output:

- 2nd Largest Element: 5

Problem 5: **Count Inversions in an Array**

An inversion is a pair of indices (i, j) such that `arr[i] > arr[j]` and `i < j`. Count the number of inversions in the given array.

Input:

- Array: [2, 4, 1, 3, 5]

Output:

- Inversions Count: 3 (Inversions: (2, 1), (4, 1), (4, 3))

Problem 6: **Rotate an Array by K Positions**

You are given an array and a number `K`. You need to rotate the array `K` positions to the right.

Input:

- Array: [1, 2, 3, 4, 5, 6, 7]
- K = 3

Output:

- Rotated Array: [5, 6, 7, 1, 2, 3, 4]

Problem 7: **Find the Majority Element**

Given an array of size `n`, find the majority element. The majority element is the element that appears more than `n/2` times in the array.

Input:

- Array: [3, 3, 4, 2, 4, 4, 2, 4, 4]

Output:

- Majority Element: 4

Problem 8: **Find the Longest Subarray with Sum Zero**

Given an array of integers, find the length of the longest subarray with sum zero.

Input:

- Array: [1, 2, -2, 4, -4, 3, -3]

Output:

- Length of Longest Subarray: 6

Problem 9: **Product of Array Except Self**

Given an integer array, return an array such that each element is the product of all the elements in the original array except for the one at the current index.

Input:

- Array: [1, 2, 3, 4]

Output:

- Output Array: [24, 12, 8, 6]

Problem 10: **Find Pairs in an Array with a Given Sum**

Given an array of integers and a target sum, find all pairs in the array whose sum is equal to the target sum.

Input:

- Array: [1, 2, 3, 4, 5, 6]
- Target Sum: 7

Output:

- Pairs: (1, 6), (2, 5), (3, 4)
