Programming Exercises Set 2

1. Validate Balanced Brackets

Problem:

Write a program that checks if a string containing brackets (), {}, and [] is balanced. A string is balanced if every opening bracket has a corresponding closing bracket in the correct order.

Test Cases:

1. "(){}[]" → True
2. "({[]})" → True
3. "({[)]}" → False
4. "((()))" → True
5. "({})[" → False

2. Find First Non-Repeating Character in a String

Problem:

Given a string, return the first character that does not repeat. If all characters repeat, return null.

Test Cases:

1. "aabbccde" → 'd'
2. "xxyz" → 'y'
3. "aabb" → null
4. "abcabc" → null
5. "swiss" → 'w'

3. Merge Two Sorted Arrays Without Duplicates

Problem:

Write a function that merges two sorted arrays into one sorted array without duplicates.

Test Cases:

1. [1, 3, 5], [2, 4, 6] → [1, 2, 3, 4, 5, 6]
2. [1, 2, 2], [2, 3, 4] → [1, 2, 3, 4]
3. [], [1, 2, 3] → [1, 2, 3]
4. [5, 6], [5, 6] → [5, 6]
5. [1, 3, 5], [] → [1, 3, 5]

4. Count Pairs with Given Sum

Problem:

Given an array of integers and a target sum, count the number of pairs that add up to the target.

Test Cases:

1. [1, 5, 7, -1], target = 6 → 2 ((1,5), (7,-1))
2. [1, 1, 1, 1], target = 2 → 6
3. [10, 12, 10, 15, -1, 7, 6], target = 16 → 2
4. [5, 5, 5, 5], target = 10 → 6
5. [1, 2, 3, 4], target = 8 → 0

5. Find Longest Consecutive Sequence in Array

Problem:

Given an unsorted array of integers, find the length of the longest consecutive elements sequence.

Test Cases:

1. [100, 4, 200, 1, 3, 2] → 4 (1,2,3,4)
2. [1, 9, 3, 10, 4, 20, 2] → 4 (1,2,3,4)
3. [5, 6, 7, 8, 9] → 5
4. [10, 30, 20] → 1
5. [1, 2, 0, 1] → 3 (0,1,2)

6. Find Majority Element in Array

Problem: Return the element that appears more than ⌊n/2⌋ times. If none, return null.

Test Cases:

1. [3, 3, 4, 2, 3, 3, 3] → 3
2. [1, 2, 3, 4] → null
3. [2, 2, 1, 1, 2, 2] → 2
4. [5, 5, 5, 5, 5] → 5
5. [1, 2, 3, 1, 1] → 1

7. Find All Subsets of a Set

Problem: Given a set of integers, return all possible subsets.

Test Cases:

1. [1, 2] → [[], [1], [2], [1,2]]
2. [1] → [[], [1]]
3. [] → [[]]
4. [1, 2, 3] → 8 subsets
5. [0, 1] → [[], [0], [1], [0,1]]

8. Binary Search in Rotated Array

Problem: Search for a target in a rotated sorted array.

Test Cases:

1. [4,5,6,7,0,1,2], target=0 → 4
2. [4,5,6,7,0,1,2], target=3 → -1
3. [1], target=1 → 0
4. [6,7,8,1,2,3,4,5], target=3 → 5
5. [2,3,4,5,1], target=1 → 4

9. Sort Array by Frequency

Problem: Sort elements by frequency (highest first). If tie, sort by value.

Test Cases:

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

5. [1] → [1]

10. Group Anagrams

Problem: Group words that are anagrams of each other.

Test Cases:

1. ["bat", "tab", "cat"] → [["bat", "tab"], ["cat"]]
2. ["listen", "silent", "enlist"] → [["listen", "silent", "enlist"]]
3. ["a"] → [["a"]]
4. ["abc", "def", "cba"] → [["abc", "cba"], ["def"]]
5. [] → []

11. Longest Palindromic Substring

Problem: Return the longest palindromic substring in a given string.

Test Cases:

1. "babad" → "bab" or "aba"
2. "cbbd" → "bb"
3. "a" → "a"
4. "forgeeksskeegfor" → "geeksskeeg"
5. "abacdfgdcaba" → "aba"

12. Find Missing Ranges

Problem: Given a sorted array and a range [lower, upper], find missing ranges.

Test Cases:

1. [1,3,5], lower=1, upper=5 → ["2", "4"]
2. [2,4], lower=1, upper=5 → ["1", "3", "5"]
3. [], lower=1, upper=3 → ["1->3"]
4. [1,2,3], lower=1, upper=3 → []
5. [1,5], lower=1, upper=5 → ["2->4"]

13. Find Peak Element

Problem: Return index of a peak element (greater than neighbors).

Test Cases:

1. [1,2,3,1] → 2
2. [1,2,1,3,5,6,4] → 5
3. [1] → 0
4. [2,1] → 0
5. [1,2] → 1

14. Find Kth Largest Element

Problem: Return the kth largest element in an array.

Test Cases:

1. [3,2,1,5,6,4], k=2 → 5
2. [3,2,3,1,2,4,5,5,6], k=4 → 4
3. [1], k=1 → 1

4. [7,10,4,3,20,15], k=3 → 10
5. [5,5,5,5], k=2 → 5

15. Spiral Order Matrix Traversal

Problem: Return elements of a matrix in spiral order.

Test Cases:

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

16. Find All Duplicates in Array

Problem: Return all elements that appear more than once.

Test Cases:

1. [4,3,2,7,8,2,3,1] → [2,3]
2. [1,1,2] → [1]
3. [1,2,3] → []
4. [5,5,5,5] → [5]
5. [10,20,10,30,20] → [10,20]

17. Find Longest Common Prefix

Problem: Return the longest common prefix among strings.

Test Cases:

1. ["flower","flow","flight"] → "fl"
2. ["dog","racecar","car"] → ""
3. ["interspecies","interstellar","interstate"] → "inters"
4. ["throne","throne"] → "throne"
5. ["prefix","preach","prevent"] → "pre"

18. Find All Palindromic Substrings

Problem: Count all palindromic substrings in a string.

Test Cases:

1. "abc" → 3
2. "aaa" → 6
3. "a" → 1
4. "ababa" → 9
5. "abcd" → 4

19. Find Triplets with Zero Sum

Problem: Return all unique triplets that sum to zero.

Test Cases:

1. [-1,0,1,2,-1,-4] → [[-1,-1,2],[-1,0,1]]
2. [0,0,0] → [[0,0,0]]

3. [1,2,-2,-1] → []
4. [-2,0,1,1,2] → [[-2,0,2],[-2,1,1]]
5. [-4,-2,-2,-2,0,1,2,2,2,3,3,4,4,6,6] → multiple triplets

20. Find Minimum Window Substring

Problem: Return the smallest substring containing all characters of another string.

Test Cases:

1. s="ADOBECODEBANC", t="ABC" → "BANC"
2. s="a", t="a" → "a"
3. s="a", t="aa" → ""
4. s="ab", t="b" → "b"
5. s="abcdebdde", t="bde" → "bdde"

21. Find All Permutations of a String

Problem: Return all permutations of a string.

Test Cases:

1. "abc" → 6 permutations
2. "a" → ["a"]
3. "ab" → ["ab", "ba"]
4. "aaa" → ["aaa"]
5. "abcd" → 24 permutations

22. Find Longest Increasing Subsequence

Problem: Return length of longest increasing subsequence.

Test Cases:

1. [10,9,2,5,3,7,101,18] → 4
2. [0,1,0,3,2,3] → 4
3. [7,7,7,7] → 1
4. [1,3,6,7,9,4,10,5,6] → 6
5. [1,2,3,4] → 4

23. Find Next Greater Element

Problem: For each element, find the next greater element to its right.

Test Cases:

1. [4,5,2,25] → [5,25,25,-1]
2. [13,7,6,12] → [-1,12,12,-1]
3. [1,3,2,4] → [3,4,4,-1]
4. [5,4,3,2,1] → [-1,-1,-1,-1,-1]
5. [2,1,2,4,3] → [4,2,4,-1,-1]

24. Find All Elements Appearing More Than n/3 Times

Problem: Return elements appearing more than n/3 times.

Test Cases:

1. [3,2,3] → [3]

2. [1,1,1,3,3,2,2,2] → [1,2]
3. [1,2] → [1,2]
4. [1,2,3,4] → []
5. [2,2,9,3,9,3,9,3,9] → [9]

25. Find All Unique Combinations That Sum to Target

Problem: Return all combinations of numbers that sum to a target.

Test Cases:

1. candidates=[2,3,6,7], target=7 → [[7],[2,2,3]]
2. candidates=[2,3,5], target=8 → [[2,2,2,2],[2,3,3],[3,5]]
3. candidates=[2], target=1 → []
4. candidates=[1], target=2 → [[1,1]]
5. candidates=[1,2], target=4 → [[1,1,1,1],[1,1,2],[2,2]]