Medium problems for Average Learners

Student Name: DEVENSH YADAV **UID:** 22BCS16082
Branch: CSE **Section/Group:** NTPP_602-A
Semester: 6 **Date of Performance:** 10-04-25
Subject Name: Advanced Programming Lab-2 **Subject Code:** 22CSH-359

Problem-1

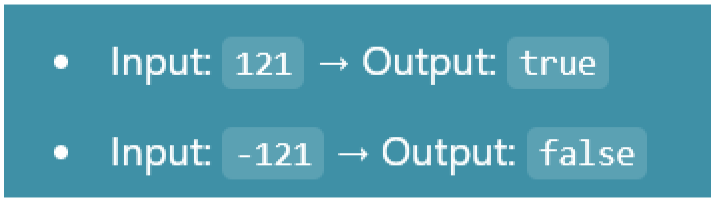
1. **Title: Palindrome Number**
2. **Objective:** To determine whether a given integer is a palindrome (reads the same forward and backward).
3. **Algorithm:**

- Input: An integer x
- Edge Case:
  - If x < 0, it cannot be a palindrome.
- Convert to String (or use digit reverse logic):
  - Convert number to string and compare it with its reverse.
- Output:
  - Return true if both match, else false.

4. **Implementation/Code:**

```
class Solution {
    public boolean isPalindrome(int x) {
        if (x < 0) return false;
        String s = Integer.toString(x);
        StringBuilder rev = new StringBuilder(s).reverse();
        return s.equals(rev.toString());
    }
}
```

5. **Output:**



- Input: 121 → Output: true
- Input: -121 → Output: false

6. **Time Complexity:** O (n)
7. **Space Complexity:** O(n)

Problem-2

1. **Title:** **Two Sum**

2. **Objective:** To find the indices of two numbers in an array that sum up to a specific target value.

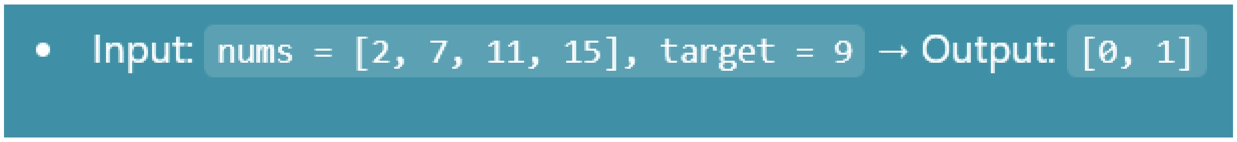
3. **Algorithm:**

- Input: Array nums, Integer target
- Use Hash Map:
    - Store each number and its index as you iterate.
    - Check if (target - current number) exists in the map.
- Output: Return the pair of indices.

4. **Implementation/Code:**

```
class Solution {
    public int[] twoSum(int[] nums, int target) {
        Map<Integer, Integer> map = new HashMap<>();
        for (int i = 0; i < nums.length; i++) {
            int diff = target - nums[i];
            if (map.containsKey(diff)) {
                return new int[]{map.get(diff), i};
            }
            map.put(nums[i], i);
        }
        return new int[]{}; // No solution found
    }
}
```

5. **Output:**



- Input: `nums = [2, 7, 11, 15], target = 9` → Output: `[0, 1]`

6. **Time Complexity:** O(n)

7. **Space Complexity:** O(n)

Problem-3

1. Title: Longest Substring Without Repeating Characters

2. Objective: To find the length of the longest substring with all unique characters.

3. Algorithm:

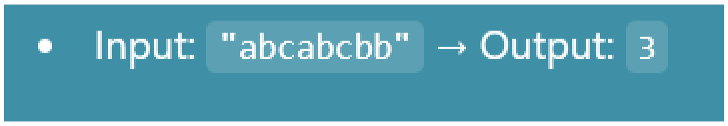
- Input: A string s
- Sliding Window + Set:
    - Use two pointers (left, right) to maintain a window of non-repeating characters.
    - Move window when duplicate is found.
- Output: Return max length found.

4. Implementation/Code:

```
class Solution {
    public int lengthOfLongestSubstring(String s) {
        Set<Character> set = new HashSet<>();
        int left = 0, maxLen = 0;

        for (int right = 0; right < s.length(); right++) {
            while (set.contains(s.charAt(right))) {
                set.remove(s.charAt(left++));
            }
            set.add(s.charAt(right));
            maxLen = Math.max(maxLen, right - left + 1);
        }
        return maxLen;
    }
}
```

5. Output:



- Input: "abcabcbb" → Output: 3

8. Time Complexity: O(n) **9. Space Complexity:** O(min(n,m))

10. Learning Outcomes:

- Understood how to handle edge cases like negatives.
- Practiced string operations to simplify integer problems.
- Applied hash map for constant-time lookup.
- Strengthened logic for pair-sum problems.
- Mastered sliding window technique.
- Learned to track seen characters efficiently with sets.