DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING

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Complex Problem Assignment

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Subject: PBLJ **Subject Code:22CSH-359**

1. **Problem:** Consider a function public String matchFound(String input 1, String input 2), where
   - input1 will contain only a single word with only 1 character replaces by an underscore '_'
   - input2 will contain a series of words separated by colons and no space character in between
   - input2 will not contain any other special character other than underscore and alphabetic characters.

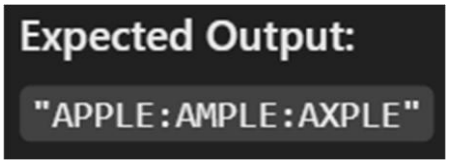
   The methods should return output in a String type variable "output1" which contains all the words from input2 separated by colon which matches with input 1. All words in output1 should be in uppercase

   Code:

```
public String matchFound(String input1, String input2) {
// Split the input2 into individual words based on colon separator.
String[] words = input2.split(":");

// Use a StringBuilder to build the output string.
StringBuilder output1 = new StringBuilder();

// Loop through each word in the array.
for (String word : words) {
    // Check if the length of the word matches the length of input1.
    if (word.length() == input1.length()) {
        boolean matches = true;
        // Compare each character.
```

```
            for (int i = 0; i < input1.length(); i++) {

                char ch1 = input1.charAt(i);
                char ch2 = word.charAt(i);
                // If the character in input1 is not underscore,
                // then it must match the corresponding character in word.
                if (ch1 != '_' && Character.toLowerCase(ch1) !=
Character.toLowerCase(ch2)) {
                    matches = false;
                    break;
                }
            }
            // If the word matches, add it (in uppercase) to the output.
            if (matches) {
                if (output1.length() > 0) {
                    output1.append(":");
                }
                output1.append(word.toUpperCase());
            }
        }
    }
    // Return the final output string.
    return output1.toString();
}
```

Output:



2. **Problem:** String t is generated by random shuffling string s and then add one more letter at a random position.
   Return the letter that was added to t.
   Code:

```
public class FindAddedLetter {
    public static char findAddedLetter(String s, String t) {
        int result = 0;
        for (char c : s.toCharArray()) {
            result ^= c;  // XOR all characters in s
        }
        for (char c : t.toCharArray()) {
            result ^= c;  // XOR all characters in t
        }
        return (char) result;  // Convert result back to char
    }

    public static void main(String[] args) {
        String s = "abcd";
        String t = "abcde";
        System.out.println("Added letter: " + findAddedLetter(s, t));  // Output:
"e"
    }
}
```

   Output:

```
Added letter: e
```

3. **Problem:** The next greater element of some element x in an array is the first greater element that is to the right of x in the same array.
   You are given two distinct 0-indexed integer arrays nums1 and nums2, where nums1 is a subset of nums2.
   For each 0 <= i < nums1.length, find the index j such that nums1[i] == nums2[j] and determine the next greater element of nums2[j] in nums2. If there is no next greater element, then the answer for this query is -1.
   Return an array ans of length nums1.length such that ans[i] is the next greater element as described above.

Code:

```
import java.util.*;

public class NextGreaterElement {
    public static int[] nextGreaterElement(int[] nums1, int[] nums2) {
        Map<Integer, Integer> nextGreaterMap = new HashMap<>();
        Stack<Integer> stack = new Stack<>();

        // Compute next greater elements for nums2
        for (int num : nums2) {
            while (!stack.isEmpty() && stack.peek() < num) {
                nextGreaterMap.put(stack.pop(), num);
            }
            stack.push(num);
        }

        // Fill result for nums1 using the precomputed map
        int[] ans = new int[nums1.length];
        for (int i = 0; i < nums1.length; i++) {
            ans[i] = nextGreaterMap.getOrDefault(nums1[i], -1);
        }
        return ans;
    }

    public static void main(String[] args) {
        int[] nums1 = {4, 1, 2};
        int[] nums2 = {1, 3, 4, 2};

        int[] result = nextGreaterElement(nums1, nums2);
        System.out.println(Arrays.toString(result));  // Output: [-1, 3, -1]
    }
}
```

Output:

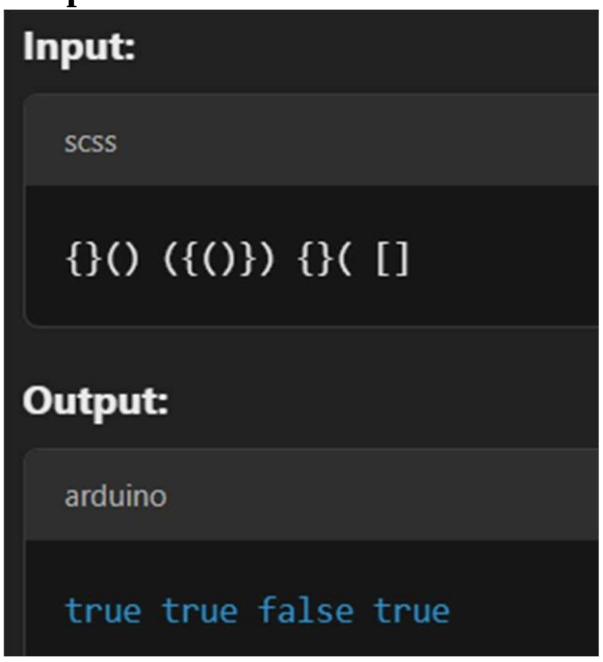
```
[-1, 3, -1]
```

4. **Problem:** A string containing only parentheses is balanced if the following is true: 1. if it is an empty string 2. if A and B are correct, AB is correct, 3. if A is correct, (A) and {A} and [A] are also correct.
Examples of some correctly balanced strings are: "{}()", "[{()}]", "({()})"
Examples of some unbalanced strings are: "{}(", "({)}", "[[", "}{" etc.
Given a string, determine if it is balanced or not.
Code:

```
import java.util.*;

public class BalancedParentheses {
    public static boolean isBalanced(String s) {
        Stack<Character> stack = new Stack<>();

        for (char c : s.toCharArray()) {
            if (c == '(' || c == '{' || c == '[') {
                stack.push(c);  // Push opening brackets
            } else if (c == ')' || c == '}' || c == ']') {
                if (stack.isEmpty()) return false;  // No matching opening bracket
                char top = stack.pop();
                if ((c == ')' && top != '(') ||
                    (c == '}' && top != '{') ||
                    (c == ']' && top != '[')) {
                    return false;  // Mismatched pair
                }
            }
        }
        return stack.isEmpty();  // If stack is empty, it's balanced
    }

    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        List<String> results = new ArrayList<>();

        while (scanner.hasNext()) {  // Read input till EOF
            String input = scanner.next();
            results.add(isBalanced(input) ? "true" : "false");
```

```
        }

        // Print results in a single line
        System.out.println(String.join(" ", results));
        scanner.close();
    }
}
```

Output:



5. **Problem:** Given an array of integers nums sorted in non-decreasing order, find the starting and ending position of a given target value.
   If target is not found in the array, return [-1, -1].
   You must write an algorithm with O(log n) runtime complexity.
   Code:

```
import java.util.Arrays;

public class FirstLastPosition {
    public static int[] searchRange(int[] nums, int target) {
        int first = findBound(nums, target, true);
        int last = findBound(nums, target, false);
        return new int[]{first, last};
    }
```

```
    private static int findBound(int[] nums, int target, boolean isFirst) {
        int left = 0, right = nums.length - 1;
        int bound = -1;

        while (left <= right) {
            int mid = left + (right - left) / 2;

            if (nums[mid] == target) {
                bound = mid;  // Store the found position
                if (isFirst) {
                    right = mid - 1;  // Search towards the left
                } else {
                    left = mid + 1;   // Search towards the right
                }
            } else if (nums[mid] < target) {
                left = mid + 1;  // Move right
            } else {
                right = mid - 1; // Move left
            }
        }
        return bound;
    }

    public static void main(String[] args) {
        int[] nums = {5,7,7,8,8,10};
        int target = 8;
        System.out.println(Arrays.toString(searchRange(nums, target)));  //
Output: [3, 4]
    }
}
```

Output:

```
[3, 4]
```