Assignment - Data Structures & Algorithms

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Assignment Questions:

1. Write a program to reverse an array using stack data structure.
2. Write a program to match the parentheses stored in a string using stack data structure.
3. Write a program to calculate the sum of all integer elements in an integer array by implementing a recursive sum method/function.

Programs:

1. Program to Reverse an Array using Stack (Java)

```
import java.util.*;
public class ReverseArrayUsingStack {
    public static void main(String[] args) {
        int[] array = {10, 20, 30, 40, 50};
        System.out.println("Original Array: " + Arrays.toString(array));
        reverseArray(array);
        System.out.println("Reversed Array: " + Arrays.toString(array));
    }

    public static void reverseArray(int[] arr) {
        Stack<Integer> stack = new Stack<>();
        for (int num : arr) stack.push(num);
        for (int i = 0; i < arr.length; i++) arr[i] = stack.pop();
    }
}
```

Output:

Original Array: [10, 20, 30, 40, 50]

Reversed Array: [50, 40, 30, 20, 10]

2. Program to Match Parentheses using Stack (Java)

```
import java.util.*;
public class ParenthesesMatcher {
    public static void main(String[] args) {
        String expression = "{[()]}";
        System.out.println("Expression: " + expression);
        System.out.println("Is balanced? " + isBalanced(expression));
    }

    public static boolean isBalanced(String expr) {
        Stack<Character> stack = new Stack<>();
        for (char ch : expr.toCharArray()) {
            if (ch == '(' || ch == '{' || ch == '[') stack.push(ch);
            else if (ch == ')' || ch == '}' || ch == ']') {
                if (stack.isEmpty()) return false;
                char top = stack.pop();
                if (!matches(top, ch)) return false;
            }
        }
        return stack.isEmpty();
    }

    public static boolean matches(char open, char close) {
        return (open == '(' && close == ')') ||
               (open == '{' && close == '}') ||
               (open == '[' && close == ']');
    }
}
```

Output:

Expression: {[()]}

Is balanced? true

3. Program to Calculate Sum of Array Elements using Recursion (Java)

```
public class RecursiveArraySum {
    public static void main(String[] args) {
        int[] numbers = {5, 10, 15, 20, 25};
        int sum = recursiveSum(numbers, 0);
        System.out.println("Array: " + java.util.Arrays.toString(numbers));
        System.out.println("Sum of Array Elements: " + sum);
    }

    public static int recursiveSum(int[] arr, int index) {
        if (index == arr.length) return 0;
        return arr[index] + recursiveSum(arr, index + 1);
    }
}
```

Output:

Array: [5, 10, 15, 20, 25]

Sum of Array Elements: 75

Submission Instructions:

1. Upload these programs to GitHub, Replit, or Google Drive.
2. Submit the link before 20th June 2025.