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PIJL Assignment-1: Calculator and Fibonacci Program

Aim:

1. *To create a Calculator program that should contain operations like addition, subtraction, multiplication, division and Fibonacci sequence.*
2. *To involve functionalities like sum of array, mean of array, variance of array, standard deviation of array.*
3. *To also contain selection of calculation functions like add, subtract etc. using switch-case or if-else*

This Document contains code for the following files:

- *UserInput.java*
- *Calculator.java*
- *Main.java*

1.

```java
//UserInput.java

// Handles user input operations for the calculator
import java.util.Scanner;

public class UserInput {
    // Scanner instance for input operations
    private Scanner scanner;

    // Initialize scanner for input handling
    public UserInput(Scanner scanner) {
        this.scanner = scanner;
    }

    // Get integer input with custom prompt
    public int getIntegerInput(String message) {
        System.out.print(message);
        return scanner.nextInt();
    }

    // Get two numbers for basic arithmetic operations
    public double[] getTwoNumbers() {
        System.out.print("Enter first number: ");
        double num1 = scanner.nextDouble();
        System.out.print("Enter second number: ");
        double num2 = scanner.nextDouble();
        return new double[]{num1, num2};
    }

    // Get array input for statistical operations
    public double[] getArrayInput() {
        System.out.print("Enter the size of the array: ");
        int size = scanner.nextInt();
        double[] array = new double[size];

        System.out.println("Enter the elements:");
        for (int i = 0; i < size; i++) {
            array[i] = scanner.nextDouble();
        }
        return array;
    }
}
```

2.

```java
// Calculator.java

// Calculator class for basic math operations
public class Calculator {

    // Basic arithmetic operations
    public double add(double a, double b) {
        return a + b;
    }

    public double subtract(double a, double b) {
        return a - b;
    }

    public double multiply(double a, double b) {
        return a * b;
    }

    public double divide(double a, double b) {
        return a / b;
    }

    // Fibonacci sequence generator
    public void fibonacci(int n) {
        int a = 0, b = 1;
        System.out.print("Fibonacci Series: " + a + " " + b);
        for (int i = 2; i < n; i++) {
            int next = a + b;
            System.out.print(" " + next);
            a = b;
            b = next;
        }
        System.out.println();
    }

    // Array operations
    public double arraySum(double[] array) {
        double sum = 0;
        for (double num : array) {
            sum += num;
        }
        return sum;
    }

    // Statistical calculations
    public double arrayMean(double[] array) {
        return arraySum(array) / array.length;
    }

    public double arrayVariance(double[] array) {
        double mean = arrayMean(array);
        double variance = 0;
        for (double num : array) {
            variance += Math.pow(num - mean, 2);
        }
        return variance / array.length;
    }

    public double arrayStdDev(double[] array) {
        return Math.sqrt(arrayVariance(array));
    }
}
```

3.

```java
// Main.java

import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        // Initialize required objects
        Scanner scanner = new Scanner(System.in);
        UserInput userInput = new UserInput(scanner);
        Calculator calculator = new Calculator();

        // Control variable for program loop
        boolean exit = false;
        while (!exit) {
            // Display menu options to the user
            System.out.println("\nSelect an operation:");
            System.out.println("1. Addition\n2. Subtraction\n3. Multiplication\n4. Division\n5. Fibonacci Sequence");
            System.out.println(
                    "6. Sum of Array\n7. Mean of Array\n8. Variance of Array\n9. Standard Deviation\n10. Exit");
            // Get user's menu choice
            int choice = userInput.getIntegerInput("Enter your choice: ");

            // Process user's choice using switch statement
            switch (choice) {
                case 1:
                    // Addition operation: Get two numbers and calculate their sum
                    double[] addInputs = userInput.getTwoNumbers();
                    System.out.println("Result: " + calculator.add(addInputs[0], addInputs[1]));
                    break;
                case 2:
                    // Subtraction operation: Get two numbers and calculate their difference
                    double[] subInputs = userInput.getTwoNumbers();
                    System.out.println("Result: " + calculator.subtract(subInputs[0], subInputs[1]));
                    break;
                case 3:
                    // Multiplication operation: Get two numbers and calculate their product
                    double[] mulInputs = userInput.getTwoNumbers();
                    System.out.println("Result: " + calculator.multiply(mulInputs[0], mulInputs[1]));
                    break;
                case 4:
                    // Division operation: Get two numbers and calculate their quotient
                    double[] divInputs = userInput.getTwoNumbers();
                    if (divInputs[1] != 0) {
                        System.out.println("Result: " + calculator.divide(divInputs[0], divInputs[1]));
                    } else {
                        System.out.println("Error: Division by zero.");
                    }
                    break;
                case 5:
                    // Fibonacci sequence operation: Get the number of terms and display the
                    // sequence
                    int n = userInput.getIntegerInput("Enter the number of Fibonacci terms: ");
                    calculator.fibonacci(n);
                    break;
                case 6:
                    // Sum of array operation: Get an array and calculate its sum
                    double[] array = userInput.getArrayInput();
                    System.out.println("Sum: " + calculator.arraySum(array));
                    break;
                case 7:
                    // Mean of array operation: Get an array and calculate its mean
                    array = userInput.getArrayInput();
                    System.out.println("Mean: " + calculator.arrayMean(array));
                    break;
                case 8:
                    // Variance of array operation: Get an array and calculate its variance
                    array = userInput.getArrayInput();
                    System.out.println("Variance: " + calculator.arrayVariance(array));
                    break;
                case 9:
                    // Standard deviation of array operation
                    array = userInput.getArrayInput();
                    System.out.println("Standard Deviation: " + calculator.arrayStdDev(array));
                    break;

                case 10:
                    // Exit the program
                    exit = true;
                    break;
```

```
                default:
                    // Handle invalid menu choice
                    System.out.println("Invalid choice. Try again.");
            }
        }
        // Close the scanner
        scanner.close();
    }
}
```

GitHub Repository Link- https://github.com/samarthsb4real/Assignment1-PIJL