Programming in Java Lab

Assignment 1

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Q1 Implement a menu-driven Java program (like fib or factorial) to implement these input methods in java

(command line args, Scanner, BufferedReader, DataInputStream, Console)

Code:

```java
/*Sameer Khatwani
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*/
package Assignment_1;

import java.util.Scanner;

// Class to calculate and print Fibonacci numbers
public class FibonacciScanner {

    // Main method to initiate program execution
    public static void main(String args[]) {

        // Create a Scanner object to take user input
        Scanner scan = new Scanner(System.in);

        // Prompt the user to enter the number of Fibonacci terms to generate
        System.out.print("Enter the number of Fibonacci numbers to generate: ");
        int n = scan.nextInt();

        // Print the first n Fibonacci numbers
        for (int i = 0; i < n; i++) {
            System.out.print(fibonacci(i) + " ");
        }

        // Close the Scanner resource
        scan.close();
    }

    // Recursive method to calculate the nth Fibonacci number
    public static int fibonacci(int n) {

        // Base cases: 0th and 1st Fibonacci numbers are 0 and 1, respectively
        if (n <= 1) {
            return n;
        } else {
```

```java
            // Iteratively calculate Fibonacci numbers
            int a = 0, b = 1, c = 0;
            for (int i = 2; i <= n; i++) {
                c = a + b;  // Calculate the next Fibonacci number
                a = b;          // Update variables for the next iteration
                b = c;
            }
            return b;  // Return the calculated Fibonacci number
        }
    }
}
```

Output:

```
Enter the number of Fibonacci numbers to generate: 5
0 1 1 2 3
```

Q2 Implement a simple menu driven calculator in java to implement add, sub, mul, div, sqrt, power, mean, variance. Implement a separate Calculator class to include all related function inside that class.

Code:

```java
/*Sameer Khatwani
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*/
package Assignment_1;

public class Main {
    public static void main(String[] args) {
        // Create an instance of UserInput to handle user input
        UserInput userInput = new UserInput();

        // Get the user's choice of operation
        String choice = userInput.getStringInput("Choose Operation: +, -, /, *, ^, var,
stddev, avg");

        // Check if the chosen operation is a basic arithmetic operation (+, -, *, /, ^)
        if (choice.equals("+") || choice.equals("-") || choice.equals("*") ||
choice.equals("/") || choice.equals("^")) {
            // Get user input for two numbers
            double n1 = userInput.getDoubleInput("Enter First Number:");
            double n2 = userInput.getDoubleInput("Enter Second Number:");
            userInput.closeScanner(); // Close the scanner since input is complete

            // Perform the chosen operation and display the result
            if (choice.equals("+")) {
                System.err.println(Calculator.add(n1, n2));
            } else if (choice.equals("-")) {
                System.err.println(Calculator.subtract(n1, n2));
            } else if (choice.equals("*")) {
                System.err.println(Calculator.multiply(n1, n2));
            } else if (choice.equals("/")) {
```

```java
                System.out.println(Calculator.divide(n1, n2));
            } else if (choice.equals("^")) {
                System.out.println(Calculator.power(n1, n2));
            } else {
                System.out.println("Invalid Operation");
            }
        } else {
            // For statistical operations (var, stddev, avg), get an array input
            double[] arr = userInput.getArrayInput();
            userInput.closeScanner(); // Close the scanner since input is complete

            // Perform the chosen statistical operation and display the result
            if (choice.equals("var")) {
                System.out.println(Calculator.variance(arr));
            } else if (choice.equals("stddev")) {
                System.out.println(Calculator.stddev(arr));
            } else if (choice.equals("avg")) {
                System.out.println(Calculator.mean(arr));
            } else {
                System.out.println("Invalid Operation");
            }
        }
    }
}
```

// UserInput.java package Assign1;

```java
// UserInput.java
package Assignment_1;

import java.util.Scanner;

public class UserInput {
    // Scanner object for reading input
    private Scanner scanner;

    // Constructor initializes the Scanner
    public UserInput() {
        scanner = new Scanner(System.in);
    }

    // Method to get a double input from the user with a prompt message
    public double getDoubleInput(String message) {
        System.out.println(message);
        return scanner.nextDouble();
    }

    // Method to get a string input from the user with a prompt message
    public String getStringInput(String message) {
        System.out.println(message);
        return scanner.nextLine();
    }
}
```

```java
    // Method to get an array input from the user with a prompt message
    public double[] getArrayInput() {
        Scanner sc = new Scanner(System.in);

        // Prompt user for the size of the array
        System.out.println("Enter the size of the array:");
        int size = sc.nextInt();

        // Create an array to store the input elements
        double[] array = new double[size];

        // Prompt user to enter each element of the array
        System.out.println("Enter elements:");
        for (int i = 0; i < size; i++) {
            // Check if the next input is a double
            if (sc.hasNextDouble()) {
                array[i] = sc.nextDouble();
            }
        }
        sc.close(); // Close the inner scanner
        return array;
    }

    // Method to close the Scanner when it is no longer needed
    public void closeScanner() {
        scanner.close();
    }
}
```

// Calculator.java package Assign1;

```java
// Calculator.java
package Assignment_1;

import java.util.Arrays;

public class Calculator {
    // Method to add two numbers
    public static double add(double n1, double n2){
        return n1 + n2;
    }

    // Method to subtract two numbers
    public static double subtract(double n1, double n2){
        return n1 - n2;
    }

    // Method to multiply two numbers
    public static double multiply(double n1, double n2){
        return n1 * n2;
    }
```

```java
    // Method to divide two numbers
    public static double divide(double n1, double n2){
        return n1 / n2;
    }

    // Method to calculate the mean (average) of an array of numbers
    public static double mean(double[] arr){
        return Arrays.stream(arr).sum() / arr.length;
    }

    // Method to calculate the square root of a number
    public static double sqrt(double n){
        return Math.pow(n, 0.5);
    }

    // Method to calculate the standard deviation of an array of numbers
    public static double stddev(double[] arr){
        double standardDeviation = 0.0;

        // Calculate the sum of squared differences from the mean
        for (double num : arr) {
            standardDeviation += Math.pow(num - mean(arr), 2);
        }

        // Calculate the square root of the average of squared differences
        return Math.sqrt(standardDeviation / arr.length);
    }

    // Method to calculate the variance of an array of numbers
    public static double variance(double[] arr){
        // Variance is the square root of the standard deviation
        return sqrt(stddev(arr));
    }

    // Method to calculate the power of a number raised to another number
    public static double power(double n1, double n2){
        return Math.pow(n1, n2);
    }
}
```

Output:

```
Choose Operation: +, -, /, *, ^, var, stddev, avg
avg
Enter the size of the array:
6
Enter elements:
3 4 5 7 8 9
6.0
```

Github Repo

Jhttps://github.com/samv28/PIJ