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Class: TE CSE

Batch:

Title: - Develop a mathematical package for Statistical operations like Mean, Median, Average, Standard deviation. Create a sub package in the math package -convert. In “convert” package provide classes to convert decimal to octal, binary, hex and vice-versa. Develop application program to use this package and build executable jar file of it.

Program:-

```
/**
 * Statistical Operations
 * to calculate the average, mean, median and standard deviation
 * present in math package!
 */
package math;

public class StatisticalOperations {

    // Function to calculate Average
    public float average(int[] arr, int n) {

        int sum = 0;
        for (int i = 0; i < n ; i++) {
            sum += arr[i];
        }

        return (sum / (float) n);
    }
}
```

// Function to calculate Mean

```
public float mean(int[] arr, int n) {
```

```
    int sum = 0;
    for (int i = 0; i < n ; i++) {
        sum += arr[i];
    }
```

```
    return (sum / (float) n);
}
```

// Function to calculate Median

```
public int medium(int[] arr, int n) {
    return (arr[n / 2]);
}
```

// Function to calculate Standard Deviation

```
public double standardDeviation(int[] arr, int n) {
```

```
    double sum = 0.0, standardDeviation = 0.0;
    for (int i = 0; i < n; i++) {
        sum += arr[i];
    }
```

```
    double mean = sum / n;
```

```
    for (double num : arr) {
        standardDeviation += Math.pow(num - mean, 2);
    }
```

```
    return (standardDeviation / n);
```

```
    }
}
```

```
/**
 * Binary to Decimal
 * it convert binary number to decimal
 * present in sub-package convert of math package
 */
package math.convert;

public class BinaryToDecimal {

    public void binaryToDecimal(int binary) {

        int n = 0, decimal = 0, m;
        m = decimal;

        while (true) {
            if (binary == 0) {
                break;
            } else {
                int temp = binary % 10;
                decimal += temp * Math.pow(2, n);
                binary = binary / 10;
                n++;
            }
        }

        System.out.println("\tBinary to Decimal of " + m + " is: " + decimal);
    }
}
```

```
/**
 * Decimal to Binary
 * it convert decimal number to binary
 * present in sub-package convert of math package
 */
package math.convert;

public class DecimalToBinary {

    public void decimalToBinary(int decimal) {

        int m = decimal;
        int binary[] = new int[40];
        int index = 0;

        while (decimal > 0) {
            binary[index++] = decimal % 2;
            decimal = decimal / 2;
        }

        System.out.print("\n\tDecimal to Binary of " + m + " is: ");
        for (int i = index - 1; i >= 0; i--) {
            System.out.print(binary[i]);
        }
    }
}
```

```

/**
 * Decimal to Hexadecimal
 * it convert decimal number to hexa
 * present in sub-package convert of math package
 */
package math.convert;

public class DecimalToHex {

    public void decimalToHex(int decimal) {

        int rem, m;
        String hex = "";
        char hexchars[] = { '0', '1', '2', '3', '4', '5', '6', '7', '8', '9', 'A', 'B', 'C', 'D', 'E', 'F' };

        m = decimal;

        while (decimal > 0) {
            rem = decimal % 16;
            hex = hexchars[rem] + hex;
            decimal = decimal / 16;
        }

        System.out.println("\tDecimal to Hexadecimal of " + m + " is: " + hex);
    }
}

```

```
/**
 * decimal to Octal
 * it convert decimal number to octal
 * present in sub-package convert of math package
 */
package math.convert;

public class DecimalToOctal {

    public void decimalToOctal(int decimal) {

        int m, i = 0;
        // array to store octal number
        int[] octalNum = new int[100];
        m = decimal;

        // counter for octal number array
        while (decimal != 0) {
            // storing remainder in octal array
            octalNum[i] = decimal % 8;
            decimal = decimal / 8;
            i++;
        }

        System.out.print("\n\tDecimal to octal of " + m + " is: ");
        // Printing octal number array in reverse order
        for (int j = i - 1; j >= 0; j--)
            System.out.print(octalNum[j]);

        System.out.println();
    }
}
```

```
/**
 * Hexa to Decimal
 * it convert hex number to decimal
 * present in sub-package convert of math package
 */
package math.convert;

public class HexToDecimal {

    public void hexToDecimal(String hex) {

        String m, digits = "0123456789ABCDEF";
        int val = 0;

        m = hex;

        hex = hex.toUpperCase();

        for (int i = 0; i < hex.length(); i++) {
            char c = hex.charAt(i);
            int d = digits.indexOf(c);
            val = 16 * val + d;
        }

        System.out.println("\tHexadecimal to Decimal of " + m + " is: " + val);
    }

}
```

```

/**
 * Octal to Decimal
 * it convert Octal number to decimal
 * present in sub-package convert of math package
 */
package math.convert;

public class OctalToDecimal {

    public void octalToDecimal(int octal) {

        int m, decimal = 0, n = 0;

        m = octal;

        // writing logic
        while (true) {
            if (octal == 0) {
                break;
            } else {
                int temp = octal % 10;
                decimal += temp * Math.pow(8, n);
                octal = octal / 10;
                n++;
            }
        }

        System.out.println("\tOctadecimal to Decimal of " + m + " is: " + decimal);
    }
}

```



```
/**
 * Application that use the math package to demostarate different classes from
 the package
 * it's the Main-Class from where the execution begins.
 */
import java.util.Scanner;

// importing the statistical operation from math package
import math.StatisticalOperations;

// importing the classes from convert sub-package present in math package
import math.convert.BinaryToDecimal;
import math.convert.DecimalToBinary;
import math.convert.DecimalToHex;
import math.convert.DecimalToOctal;
import math.convert.HexToDecimal;
import math.convert.OctalToDecimal;

public class Mathematical {

    public static void main(String[] args) {

        // creating objects or instances
        StatisticalOperations sos = new StatisticalOperations();

        BinaryToDecimal btd = new BinaryToDecimal();
        DecimalToBinary dtb = new DecimalToBinary();
        DecimalToHex dth = new DecimalToHex();
        DecimalToOctal dto = new DecimalToOctal();
        HexToDecimal htd = new HexToDecimal();
        OctalToDecimal otd = new OctalToDecimal();

        Scanner sc = new Scanner(System.in);
        int ch, n = 0, m, binary, decimal, octal;
```

```

float mn, avg;
double sd;
String hex;
int arr[] = new int[n];

while(true){
    // displaying the list
    System.out.println("\n\n\t<-----Mathematical Package-----
----->\n\n");

    System.out.println("\tOperations: ");
    System.out.println("\t1:Average\t\t\t2:Mean\t\t\t\t3:Median");
    System.out.println("\t4:Standerd Deviation\t5:Binary To Decimal\t6:D
ecimal To Binary");
    System.out.println("\t7:Decimal To Hex\t8:Decimal To Octal\t9:Hex T
o Decimal");
    System.out.println("\t10:Octal To Decimal\t11:Exit\n");
    System.out.print("\t\tSelect your choise: ");
    ch = sc.nextInt();

    // switch case
    switch (ch) {
        case 1:
            System.out.println("\n\t\tFinding Average!\n");
            System.out.print("\tEnter Size of Array: ");
            n = sc.nextInt();
            arr = getArrayElements(n);

            avg = sos.average(arr, n);

            System.out.println("\tAverage ::" + avg);
            break;
        case 2:
            System.out.println("\n\t\tFinding Mean!\n");
            System.out.print("\tEnter Size of Array: ");

```

```

n = sc.nextInt();
arr = getArrayElements(n);

mn = sos.mean(arr, n);

System.out.println("\tMean ::" + mn);
break;
case 3:
System.out.println("\n\t\tFinding Median!\n");
System.out.print("\tEnter Size of Array");
n = sc.nextInt();
arr = getArrayElements(n);

m = sos.medium(arr, n);

System.out.println("\tMedian ::" + m);
break;
case 4:
System.out.println("\n\t\tFinding Standerd Deviation!\n");
System.out.print("\tEnter Size of Array: ");
n = sc.nextInt();
arr = getArrayElements(n);

sd = sos.standerdDeviation(arr, n);

System.out.println("\tStanderd Deviation ::" + sd);
break;

case 5:
System.out.println("\n\t\tBinary To Decimal!\n");
System.out.print("\tEnter the Binary number: ");
binary = sc.nextInt();

btd.binaryToDecimal(binary);
break;

```

case 6:

```
System.out.println("\n\t\tDecimal To Binary!\n");
System.out.print("\tEnter the Decimal number: ");
decimal = sc.nextInt();
```

```
dtb.decimalToBinary(decimal);
break;
```

case 7:

```
System.out.println("\n\t\tDecimal To Hexadecimal!\n");
System.out.print("\tEnter the Decimal number: ");
decimal = sc.nextInt();
```

```
dth.decimalToHex(decimal);
break;
```

case 8:

```
System.out.println("\n\t\tDecimal to Octal!\n");
System.out.print("\tEnter the Decimal number: ");
decimal = sc.nextInt();
```

```
dto.decimalToOctal(decimal);
break;
```

case 9:

```
System.out.println("\n\t\tHexadecimal to Decimal!\n");
System.out.print("\tEnter the hexadecimal number: ");
hex = sc.next();
```

```
htd.hexToDecimal(hex);
break;
```

case 10:

```
System.out.println("\n\t\tOctal to Decimal!\n");
System.out.print("\tEnter the octal number: ");
octal = sc.nextInt();
```

```
otd.octalToDecimal(octal);
break;
```

```

        case 11:
            System.exit(0);
            break;
        default:
            System.out.println("Enter the correct choice!");
    }
}

}

public static int[] getArrayElements(int n) // Function to ready the array and returns the array.
{
    int arr[] = new int[n];
    Scanner sc = new Scanner(System.in);

    System.out.print("\n\tEnter " + n + " numbers : ");
    for (int i = 0; i < n ; i++) {
        arr[i] = sc.nextInt();
    }

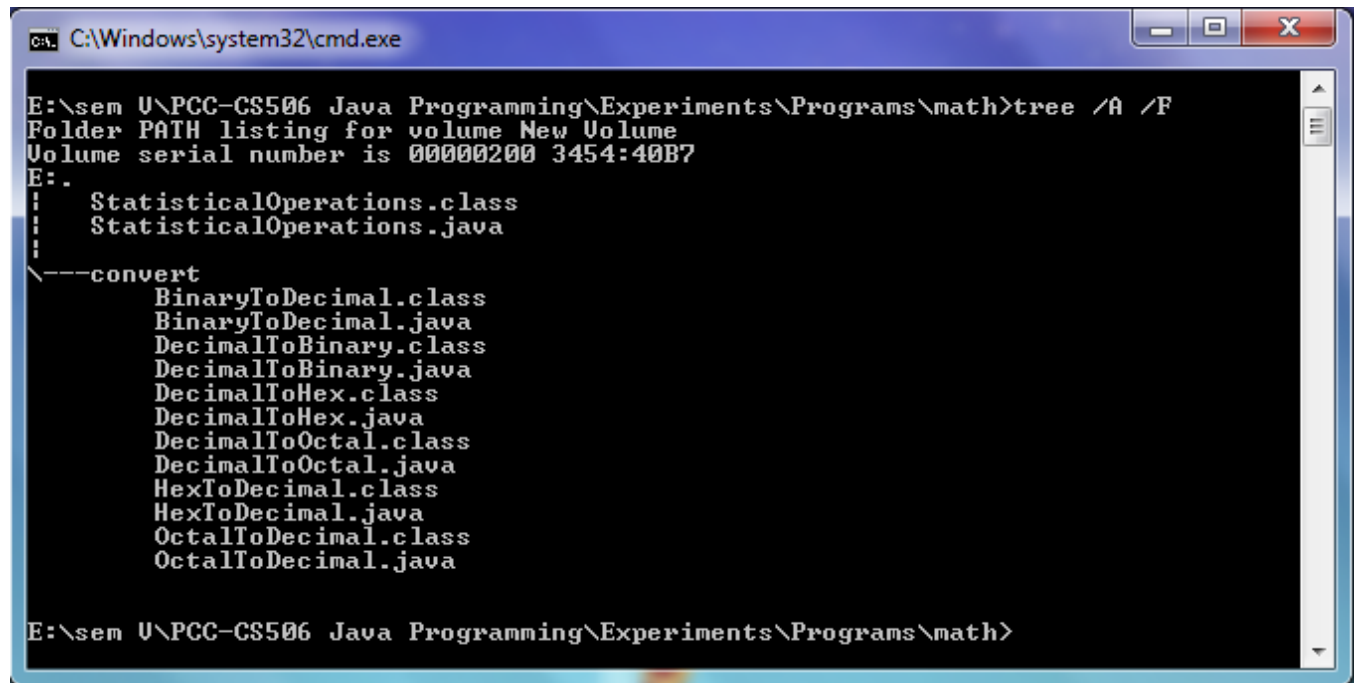
    return arr;
}
}

```

File- Manifest.txt

Main-Class: Mathematical

Package hierarchy:



```
C:\Windows\system32\cmd.exe

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs\math>tree /A /F
Folder PATH listing for volume New Volume
Volume serial number is 00000200 3454:40B7
E:.
  StatisticalOperations.class
  StatisticalOperations.java
  ---convert
    BinaryToDecimal.class
    BinaryToDecimal.java
    DecimalToBinary.class
    DecimalToBinary.java
    DecimalToHex.class
    DecimalToHex.java
    DecimalToOctal.class
    DecimalToOctal.java
    HexToDecimal.class
    HexToDecimal.java
    OctalToDecimal.class
    OctalToDecimal.java

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs\math>
```

Output 1:-

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>javac Mathematical.java

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>java Mathematical

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex   8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 1

Finding Average!

Enter Size of Array: 5

Enter 5 numbers : 2 4 6 8 10
Average ::6.0

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex   8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 11

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>_
```

Output 2:-

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>javac Mathematical.java

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>java Mathematical

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex    8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 5

Binary To Decimal!

Enter the Binary number: 1010
Binary to Decimal of 0 is: 10

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex    8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 6

Decimal To Binary!

Enter the Decimal number: 10
Decimal to Binary of 10 is: 1010

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex    8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 11

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>_
```


Creating jar file:-

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>jar cvfm Mathematical.j
ar manifest.txt Mathematical.class math/*.class math/convert/*.class
added manifest
adding: Mathematical.class(in = 3670) (out= 1961)(deflated 46%)
adding: math/StatisticalOperations.class(in = 818) (out= 537)(deflated 34%)
adding: math/convert/BinaryToDecimal.class(in = 845) (out= 539)(deflated 36%)
adding: math/convert/DecimalToBinary.class(in = 822) (out= 530)(deflated 35%)
adding: math/convert/DecimalToHex.class(in = 967) (out= 598)(deflated 38%)
adding: math/convert/DecimalToOctal.class(in = 854) (out= 550)(deflated 35%)
adding: math/convert/HexToDecimal.class(in = 958) (out= 617)(deflated 35%)
adding: math/convert/OctalToDecimal.class(in = 847) (out= 542)(deflated 36%)

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>_
```

Running the jar file (Output 1):-

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>java -jar Mathematical.
jar

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex   8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choice: 1

Finding Average!

Enter Size of Array: 5

Enter 5 numbers : 2 4 6 8 10
Average ::6.0

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex   8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choice: 11

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>
```

Running the jar file (Output 2):-

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>java -jar Mathematical.jar

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex    8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 7

Decimal To Hexadecimal!

Enter the Decimal number: 15
Decimal to Hexadecimal of 15 is: F

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex    8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 9

Hexadecimal to Decimal!

Enter the hexadecimal number: F
Hexadecimal to Decimal of F is: 15

<-----Mathematical Package----->

Operations:
1:Average          2:Mean          3:Median
4:Standerd Deviation 5:Binary To Decimal 6:Decimal To Binary
7:Decimal To Hex    8:Decimal To Octal  9:Hex To Decimal
10:Octal To Decimal 11:Exit

Select your choise: 11

E:\sem U\PCC-CS506 Java Programming\Experiments\Programs>
```