The Calculator Application

Learning Objectives

The development process of the Calculator application will aid the students to:

- Create a simple Java console application
- Understand the object-oriented concepts of inheritance, polymorphism and data hiding
- Create application which request input from users, validate, process the input received and provide desired output.
- Use features of java like type conversion, interfaces, inheriting interfaces, looping and branching, packages and I/O classes.

Understanding the Calculator Application

The Calculator application performs both basic and scientific operations. The application provides user an option to choose between the basic mode and scientific mode. Based on the option selected by the user, the application calls the corresponding class and the user can perform various mathematical operations provided in the class. There is a base class in the application which contains all the methods for calculation, basic as well as scientific. The application validates the user input also and provides appropriate messages when wrong input is given by the user.

Creating the Calculator Application

To create the Calculator application, 5 java files were created. First, an interface iCalc, with the file name "iCalc.java" is created. Then, we create the base class Calculate, with the file name "Calculate.java" which contains all the methods for calculation option selected by user.

Creating the Java Files

The Calculate Class (Calculate.java)

Class Calculate contains the business logic of the Calculator application. It contains the methods for calculation of various mathematical operations like addition, divide and tangent. Class Calculate uses interfaces by implementing Interface iCalc. The class contains following methods:

Math class Methods	Description
Addition	Takes two user inputs and adds them together
Subtraction	Takes two user inputs and subtracts them
Multiplication	Takes two user inputs and multiplies them
Division	Takes two user inputs and divides them
Sin	Takes a user input and multiplies it by Sin
Cos	Takes a user input and multiplies it by Cos
Tan	Takes a user input and multiplies it by Tan

Asin	Takes a user input, converts to radians and multiplies it by Asin
Acos	Takes a user input, converts to radians and multiplies it by Acos
Atan	Takes a user input, converts to radians and multiplies it by Atan
Exponent	Takes two user inputs, the operation takes the second input to the power of the first.
Log	takes a user input and multiplies it by log
Squareroot	Takes a user input and finds the square root of it.
Percentage	Takes two user inputs, one a quantity and another a total, takes the percentage of them.
Power of 2	Takes an input and takes it to the power of two.
Euler	Takes an input and multiplies it by Euler's number
Pi	Takes an input and multiplies it by Pi number
Max	Takes four user inputs and finds the maximum of the numbers
Min	Takes four user inputs and finds the minimum of the numbers
Quit	When selection q is picked it will end the program

The Calculator Class (Calculator.java)

Class Calculator calculates basic operations, namely, addition, subtraction, multiplication and division of two numbers. The class provides option to user to enter first number to be calculated, then the operation to be performed and then, the second number to be used for calculation.

Working with the Calculator application

The steps for working with the Calculator application are:

- In the command prompt, go to the parent directory of "Calculator" directory which contains the class files for Calculator application.

- Enter 'b' (for Basic operations) or 's' (for scientific operations) depending on the operations to be performed.
- If 'b' is entered, the following input is to be entered by the user:

    o First Number
    o Operator
    o Second Number

- The result is shown on the command prompt based on the above values.
- Enter 'y' to continue or 'n' to discontinue using the application.
- If 's' is entered, the following input is to be entered by the user:

  - Operator
  - Number

- The result is shown on the command prompt based on the above values.
- Enter 'y' to continue or 'n' to discontinue using the application.

Code for the Calculator Application

Calculator.java

```
/*************

-- Class Calculator Performs basic operations like Add, Substract, Multiply, Division for two numbers

*************/

package CS103Class;

import java.text.Format;
import java.text.NumberFormat;
import java.util.*;

public class BasicCalc {

        public static void main(String[] args) {
Scanner scan = new Scanner(System.in);

                float a,b,res = 0;

                double c;

                char choice, ch;

                NumberFormat nf1 = NumberFormat.getPercentInstance();

                do {
                //prepare the menu for user
                        System.out.println("\n\nMain Menu: \n1.Addition\n2.Subtraction" +
"\n3.Multiplication\n4.Division\n5.Sin\n6.Cos\n7.Tan\n8.Asin\n9.Acos\n10.ATan" +
                        "n11.Exp - E\\n12.Log - l\\n13.Sqrt - r\n14.Percent - p\n15.Exponent - ^\n16.Euler
- e\n17.Pi - ~\n18.Maximum - M\n19.min - m\n20.quit - q");

                        System.out.println("Enter your choice: ");
                        choice = scan.next().charAt(0);

                        switch(choice) {

                        case '1':
                                System.out.println("Enter two numbers: ");
                                a = scan.nextFloat();
```

```java
                b = scan.nextFloat();
                res = a+b;
                System.out.println("Result: " + res);
                break;
        case '2':
                System.out.println("Enter two numbers: ");
                a = scan.nextFloat();
                b = scan.nextFloat();
                res = a-b;
                System.out.println("Result: " + res);
                break;
        case '3':
                System.out.println("Enter two numbers: ");
                a = scan.nextFloat();
                b = scan.nextFloat();
                res = a*b;
                System.out.println("Result: " + res);
                break;
        case '4':
                System.out.println("Enter two numbers: ");
                a = scan.nextFloat();
                b = scan.nextFloat();
                res = a/b;
                System.out.println("Result: " + res);
                break;
        case '5':
                System.out.println("Enter a number: ");
                a = scan.nextFloat();
                res = (float) Math.sin(a);
                System.out.println("Result: " + res);
                break;
        case '6':
                System.out.println("Enter a number: ");
                a = scan.nextFloat();
                res = (float) Math.cos(a);
                System.out.println("Result: " + res);
                break;
        case '7':
                System.out.println("Enter a number: ");
                a = scan.nextFloat();
                res = (float) Math.tan(a);
                System.out.println("Result: " + res);
                break;
        case 's':
                System.out.println("Enter a number: ");
                a = scan.nextFloat();
                c = Math.toRadians(a);
                res = (float) Math.asin(c);
                System.out.println("Result: " + res);
                break;
        case 'c':
                System.out.println("Enter a number: ");
                a = scan.nextFloat();
                c = Math.toRadians(a);
                res = (float) Math.acos(c);
                System.out.println("Result: " + res);
```

```java
                break;
case 't':
        System.out.println("Enter a number: ");
        a = scan.nextFloat();
        c = Math.toRadians(a);
        res = (float) Math.atan(a);
        System.out.println("Result: " + res);
        break;
case 'e':
        System.out.println("Enter a number: ");
        a = scan.nextFloat();
        System.out.println("Enter a exponent: ");
        b = scan.nextFloat();
        res =(float) Math.pow(a, b);
        System.out.println("Result: " + res);
        break;
case 'l':
        System.out.println("Enter a number: ");
        a = scan.nextFloat();
        System.out.println("Enter the next number: ");
        b = scan.nextFloat();
        res = (float) Math.log(a);
        break;
case 'r':
        System.out.println("Enter a number: ");
        a = scan.nextFloat();
        res = (float) Math.sqrt(a);
        System.out.println("Result: " + res);
        break;

case 'p':
        System.out.println("Enter a quantity : ");
        a = scan.nextFloat();
        System.out.println("Enter a total: ");
        b = scan.nextFloat();
        res = (a/b);
        System.out.println("Result: " + nf1.format(res));
        break;

case '^':
        System.out.println("Enter a number: ");
        a = scan.nextFloat();
        res = (float) Math.pow(a, 2);
        System.out.println("Result: " +res);
        break;

case 'u':
        System.out.println("Enter a number: ");
        a = scan.nextFloat();
        double e = 2.718281828459045235360287471352;
        res = (float) ((double) a*e) ;
        System.out.println("Result: " + res);

case '~':
        System.out.println("Enter a number");
        a = scan.nextFloat();
```

```java
                                double pi = 3.14;
                                res = (float) ((float) a*pi);
                                System.out.println("Result: " + res);

                        case 'M':
                                System.out.println("Enter 4 numbers: ");
                                int num1, num2, num3, max = 0;
                                num1 = scan.nextInt();
                                num2 = scan.nextInt();
                                num3 = scan.nextInt();
                                if (num1>num2 && num1>num3)
                                        max=num3;
                        else if (num2>num3)
                                max= num2;
                        else
                                max=num3;
                        System.out.println("Result:" + max);
                                break;

                        case 'm':
                                System.out.println("Enter ");
                                System.out.println("Enter 4 numbers: ");
                                int nume1, nume2, nume3, min = 0;
                                nume1 = scan.nextInt();
                                nume2 = scan.nextInt();
                                nume3 = scan.nextInt();
                                if (nume1<nume2 && nume1<nume3)
                                        min=nume3;
                        else if (nume2<nume3)
                                min= nume2;
                        else
                                min=nume3;
                        System.out.println("Result: " + min);
                                break;


                        case 'q':
                                System.exit(0);
                                break;

                        default:
                                System.out.println("Choice is invalid.");
                                break;

                        }

                }
                while(choice!='q');

        }

}
```