# Programming Exercise
# FunWithNumbers

Specification:
Write a C++ source program that performs 7 distinct calculations within a do-while loop that allows the user to repeat the entire program.

1. Part 1 calculates the mean of 3 user-provided input values. Prompt the user and receive the 3 numbers (of type float). Call a value-returning function named *float CalcMean*, passing the 3 values as arguments. Receive the mean back as the function return value, and present it as a number with 4 decimal places.

2. Part 2 calculates the absolute value of a floating point number and the absolute value of an integer, all within the main function. Prompt the user for a floating point number, and then display the absolute value to 3 decimal places. Prompt the user for an integer and display its absolute value. (No change to this part from the program for Chapter 03.)

3. Part 3 calculates the results of an integer divide operation within the main function. Prompt the user for the dividend and the divisor, and then present the quotient and the remainder. (No change from the Chapter 03 program.)

4. Part 4 calculates a discounted price, and then rounds it properly to 2 decimal places. Prompt the user for a price and a discount percentage. Calculate the discounted price in *main*, and then pass the discounted price to a value-returning function named *float RoundTo2*. Receive the rounded value back as the function value. Display it with a precision of 2 decimal places. (No change from the Chapter 03 program.)

5. Part 5 calculates the volume of a right linear cone. Prompt the user for the cone's radius and height, and pass them to a value-returning function named *float CalcVolumeCone*. Receive the volume back as the function value and display it with a precision of 4 decimal places.

6. Part 6 calculates the volume of a sphere. Prompt the user for the sphere's radius, and pass it to a value-returning function named *float CalcVolumeSphere*, which will return the volume of the sphere as the function value. Display it with 4 decimal places.

7. Part 7 calculates the surface area of a sphere. Prompt the user for the sphere's radius, and pass it to a value-returning function named *float CalcSurfaceSphere*, which will return the surface area as the function value. Display it with 4 decimal places.

```java
package homework_2;

/**
 * Programming Exercise for Chapter 04
 * FunWithNumbersDecomposed.java
 *
 * Author   J.W. Broere
 * Date     12/12/2011
 *
 */

import java.util.*;

public class FunWithNumbersDecomposed {

    static public final double dPI = Math.PI; // class instance constant

    static public void main (String[] args)
    {
        // variables
        Scanner input = new Scanner(System.in);
        char cRepeat;

        do
        {
            /*
             * part 1 - calculate the mean of 3 input values
             * display to 4 places
             *
             */

            //input variables for part 1
            float fTemp1, fTemp2, fTemp3;

            System.out.println("Part 1: Calculate the arithmetic mean of 3 input values");
            System.out.print("Enter any number: ");
            fTemp1 = input.nextFloat();
            System.out.print("Enter any number: ");
            fTemp2 = input.nextFloat();
```

```
40              System.out.print("Enter any number: ");
41              fTemp3 = input.nextFloat();
42              System.out.printf("The mean is %.4f%n%n", CalcMean(fTemp1, fTemp2, fTemp3));
43
44              /*
45               *  part 2 - calculate the absolute value of a float and an integer
46               *  display to 3 places
47               *
48               */
49
50              // input variables for part 2
51              float fAbsInput;
52              int iAbsInput;
53
54              System.out.println("Part 2: Calculate the absolute value of a float and an integer");
55              System.out.print("Enter a floating point number: ");
56              fAbsInput = input.nextFloat();
57              System.out.printf("The absolute value is %.3f%n", Math.abs(fAbsInput));
58              System.out.print("Enter an integer: ");
59              iAbsInput = input.nextInt();
60              System.out.printf("The absolute value is %d%n%n", Math.abs(iAbsInput));
61
62              /*
63               *  part 3 - calculate quotient and remainder of an integer
64               *
65               */
66
67              // input variables for part 3
68              int iDividend, iDivisor;
69
70              System.out.println("Part 3: Calculate the results of an integer divide operation");
71              System.out.print("Enter the dividend as an integer: ");
72              iDividend = input.nextInt();
73              System.out.print("Enter the divisor as an integer (cannot be zero): ");
74              iDivisor = input.nextInt();
75
76              while (iDivisor == 0) { // range validity check
77                  System.out.print("Invalid...Enter the divisor as an integer (cannot be zero): ");
78                  iDivisor = input.nextInt();
```

```
79          }
80
81          System.out.printf("The quotient is %d and the remainder is %d%n%n", iDividend / iDivisor, iDividend % iDivisor);
82
83          /*
84           *  part 4 - calculate the rounded value of dollars and cents
85           *
86           */
87
88          // input and output variables for part 4
89          float fPrice, fDiscount;
90          float fDiscountPrice;
91
92          System.out.println("Part 4: Round a discounted dollar value to the nearest cent");
93          System.out.print("Enter a price: $");
94          fPrice = input.nextFloat();
95          System.out.print("Enter a discount as a percentage (such as 7.5): ");
96          fDiscount = input.nextFloat();
97          fDiscountPrice = fPrice * (1.0f - (fDiscount / 100.f));
98          System.out.printf("The discounted price is %f%n", fDiscountPrice);
99          System.out.printf("The rounded discounted price is $%.2f%n%n", RoundTo2(fDiscountPrice));
100
101         /*
102          *  part 5 - calculate the volume of a cone
103          *
104          */
105
106         // input variables for part 5
107         double dConeRadius, dConeHeight;
108
109         System.out.println("Part 5: Calculate the volume of a right linear cone");
110         System.out.print("Enter radius of cone: ");
111         dConeRadius = input.nextDouble();
112         System.out.print("Enter height of cone: ");
113         dConeHeight = input.nextDouble();
114         System.out.printf("Volume of cone is %.4f%n%n", CalcVolumeCone(dConeRadius, dConeHeight));
115
116         /*
117          *  part 6 - calculate the volume of a sphere
```

```
118             *
119             */
120
121            // input variables for part 6 and 7
122            double dSphereRadius;
123
124            System.out.println("Part 6: Calculate the volume of a sphere");
125            System.out.print("Enter radius of sphere: ");
126            dSphereRadius = input.nextDouble();
127            System.out.printf("Volume of sphere is %.4f%n%n", CalcVolumeSphere(dSphereRadius));
128
129            /*
130             *  part 7 - calculate the surface area of a sphere
131             *
132             */
133
134            System.out.println("Part 7: Calculate the surface area of a sphere");
135            System.out.print("Enter radius of sphere: ");
136            dSphereRadius = input.nextDouble();
137            System.out.printf("Surface area of sphere is %.4f%n%n", CalcSurfaceSphere(dSphereRadius));
138
139            // prompt the user and repeat program if desired
140            System.out.print ("Repeat program? (y or n): ");
141            cRepeat = Character.toUpperCase(input.next().charAt(0)); // extract user's reply
142
143            // valid input validation loop
144            while (cRepeat != 'Y' && cRepeat != 'N') {  // range check
145                System.out.print("Please answer y or n: ");
146                cRepeat = Character.toUpperCase(input.next().charAt(0)); // extract user's reply
147            }
148
149        } while (cRepeat == 'Y'); // loop until user enters n to quit
150
151        // final announcement
152        System.out.println ("Program has ended");
153
154        input.close();
155
156    } // main
```

```
157
158     /*******************************************************************************
159      * float CalcMean method definition
160      *
161      * Function: calculate arithmetic mean of 3 input values
162      *
163      * Pre:     fX, fY, fZ have been assigned
164      * @param fX
165      * @param fY
166      * @param fZ
167      *
168      * Post:    arithmetic mean has been returned
169      * @return
170      *
171      */
172     static float CalcMean (float fX, float fY,  float fZ) {
173         return (fX + fY + fZ) / 3.0f;
174     } // CalcMean
175
176     /*******************************************************************************
177      * float RoundTo2 method definition
178      *
179      * Function: round a floating point value to 2 decimal places
180      *
181      * Pre:     fX has been assigned
182      * @param fX
183      *
184      * Post:    rounded value has been returned
185      * @return
186      *
187      */
188     static float RoundTo2 (float fX) {
189         return (float)((int)(fX * 100.0f + .5f)) / 100.0f;
190     } // RoundTo2
191
192     /*******************************************************************************
193      * double CalcVolumeCone method definition
194      *
195      * Function: calculate volume of right linear cone
```

```
196      *
197      * Pre:     dR, dH have been assigned
198      *          dR, dH > 0.0
199      * @param dR
200      * @param dH
201      *
202      * Post:    volume has been returned
203      * @return
204      *
205      */
206     static double CalcVolumeCone (double dR, double dH) {
207         return dPI * Math.pow(dR, 2) * dH / 3.0;
208     } // CalcVolumeCone
209
210     /*****************************************************************************
211      * double CalcVolumeSphere method definition
212      *
213      * Function: calculate the volume of a sphere
214      *
215      * Pre:     dR has been assigned and dR > 0.0
216      * @param dR
217      *
218      * Post:    volume has been returned
219      * @return
220      *
221      */
222     static double CalcVolumeSphere (double dR) {
223         return 4.0 * dPI * Math.pow(dR, 3) / 3.0;
224     } // CalcVolumeSphere
225
226     /*****************************************************************************
227      * double CalcSurfaceSphere method definition
228      *
229      * Function: calculate the surface area of a sphere
230      *
231      * Pre:     dR has been assigned and dR > 0.0
232      * @param dR
233      *
234      * Post:    surface area has been returned
```

```
235      * @return
236      *
237      */
238     static double CalcSurfaceSphere (double dR) {
239         return 4.0 * dPI * Math.pow(dR, 2);
240     } // CalcSurfaceSphere
241
242 } // FunWithNumbersDecomposed
243
```