Zambia Centre for Accountancy Studies

NCC Diploma in Computing – Level 4

DDOOCP – Java

Problem Set 1.0

Due Date: Week Beginning 26th August, 2013

You are required to solve all the problems. Your solutions must be properly planned for and well thought out before any implementation in Java.

1.0 A trapezoid is a four-sided geometric figure (quadrilateral) in which two sides, called the bases are parallel. The area of a trapezoid is given as one-half the product of the height and the sum of the lengths of the two bases, base1 and base2. Symbolically,

A = (base1 + base2) x h/2

The height h is the distance between the two parallel lines. Develop an algorithm that calculates and prints the area of a trapezoid when the values of the bases and height are given as input. You should effectively design your classes, clearly indicating the state and methods using a Class icon. Further, implement your algorithm/class in Java and generate a working program.

2.0 A person who travels between Lusaka and Cape Town needs an algorithm that accepts a number representing either a Fahrenheit or a Celsius temperature scale and converts it to the other scale. For instance, the temperature conversion in Celsius is given by:

CelsTemp = 5/9 * (FahrenTemp – 32)

You should effectively design your classes, clearly indicating the state and methods using a Class icon. Further, implement your algorithm/class in Java and generate a working program.

3.0 The monthly payment on a mortgage is calculated according is calculated according to the formula:

$$M = (P \times i \times (1 + i)^n) / ((1 + i)^n - 1)$$

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Where
P represents the principal
i represents the monthly interest (= yearly rate /12)
n represents the number of payments (= NoOfYears x 12)

Write an algorithm that inputs values for the principal, yearly interest rate, and term in years and outputs the corresponding monthly payment. The algorithm should allow many runs.
You should effectively design your classes, clearly indicating the state and methods using a Class icon. Further, implement your algorithm/class in Java and generate a working program.

4.0 Revise the algorithm from question 3.0 to allow for input checking. Assume the following bank-imposed limitations on borrowing.

Input Parameter	Minimum Value	Maximum Value
Principal	**50,000,000**	**100,000,000**
Yearly interest	**5%**	**15%**
Term in years	**10**	**40**

Incorporate these restrictions in your program generated in 3.0.

5.0 Any equation of the form $\mathbf{ax^2 + bx + c = 0}$ where a ≠ 0 is called a quadratic equation. And **a**, **b** and **c** are real numbers.

We normally use the formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

to find the roots of the quadratic equation. However, not all quadratic equations will have roots.

The Discriminant, **D** is used to determine the nature of the roots.

$$\mathbf{D = b^2 - 4ac}$$

If **D > 0** then the quadratic equation has two distinct real roots.

If **D = 0** then the quadratic equation has one real root, **x = -b/2a.**

And if **D < 0** then the quadratic equation has no real roots. In fact, it has complex roots.

Further if **a = 0** and **b ≠ 0** and **c ≠ 0** then **x = - b/c** and if **a = b = c = 0** then the quadratic equation has an infinite number of roots.

Required:

Use the above logic to generate a Java computer program to calculate the roots of the quadratic equation.