5.3 LAB TASKS

Guessing geometric shape

1. A parallelogram is a special kind of quadrilateral in which both pairs of opposite sides are parallel and both pairs of opposite angles are equal. Three famous parallelograms are following:
   Rectangle: Only opposite side are equal, all angles 90 degrees
   Square: All sides are equal, all angles 90 degrees
   Rhombus: All sides are equal, no angle is 90 degrees
   Your job is to apply the concept of **nested *if-else*** and ask user useful questions to guess the nature of a parallelogram. The questions should be such as that user can only type YES or NO as a response. For example:
   Are all the sides equal?
   YES
   Are all the angles 90 degrees?
   NO
   It is rhombus!!
   By eliminating the possibilities one by one, program should finally discover the actual shape in user's mind.
   Note that the input from the user should be in all caps.

   [25 marks]

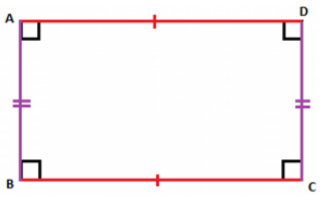

Figure 1 Rectangle

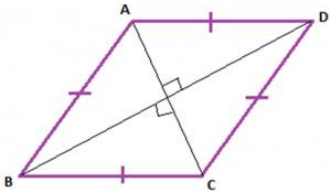

Figure 2 Rhombus

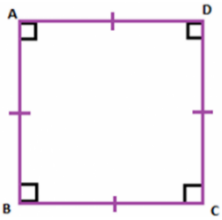

Figure 3 Square

2. Write a program that prompts the user for their water bill for the last four months. The program should find and output their average monthly water bill. If the average bill exceeds $75, the output should include a message indicating that too much water is being used. If the average bill is at least $25 but no more than $75, the output should indicate that a typical amount of water is being used. Finally, if the average bill is less than $25, the output should contain a message praising the user for conserving water. If the user enters non-numeric or negative values for any of the monthly bills, the program should terminate with an appropriate error message.

   [25 marks]

To find the nature of the roots of quadratic equation

3. We all know the quadratic formula used to find the roots of a quadratic equation $ax^2 + bx + c = 0$ is as:

$$x1, x2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

But your task is to write a C++ program which will discover the nature of these roots. Before you start you must know that the expression $b^2 - 4ac$ in the above formula is very important for this task. This is known as ***discriminant*** and useful in the following way:

Value of Discriminant	Nature of Roots	
D > 0	Real, Distinct	
	D is a perfect square	Rational roots
	D is not a perfect square	Irrational roots
D = 0	Real, Equal	
D < 0	Complex, Distinct (A pair of complex conjugates)	

So now you are aware that how the value of the discriminant can be helpful in order to discover the nature of the roots of a quadratic equation.

You are required to get the values of a, b and c from the user and then compute the value of discriminant only. Check for this value and display the relevant information about the nature of the roots to the user. In case **when D > 0** display:

Roots are real
Roots are distinct

And then further check for D to be a perfect square or not. Display 3rd information Roots are rational/irrational accordingly.

In other cases, only one check is enough to discover the nature.

[30 marks]

4. Write a program for a basic calculator which performs addition, subtraction, multiplication and division of 2 **real numbers** and shows the result after each operation. Write a code to display a menu on the screen like:
   Press 1 to perform addition.
   Press 2 to perform subtraction.
   Press 3 to perform multiplication.
   Press 4 to perform division.

   Use **switch statement** where it is appropriate, calculate and display the results on the screen.

   [20 marks]