C PROGRAMMING
ASSIGNMENT 03.02

Problem 1: Write a C program to calculate the roots of a quadratic equation of the form `ax^2 + bx + c = 0`. The program should handle different cases, such as real and distinct roots, real and equal roots, and imaginary roots.

Solution Approach:

1. Prompt the user to input the coefficients `a`, `b`, and `c` of the quadratic equation.
2. Calculate the discriminant (`D = b^2 - 4ac`).
3. Based on the discriminant value, determine the nature of the roots:
   - If `D > 0`, calculate and print two real and distinct roots.
   - If `D == 0`, calculate and print two real and equal roots.
   - If `D < 0`, calculate and print two complex (imaginary) roots.
4. Print the calculated roots.

- **Test Case 1:**
  Input: `a = 1, b = -3, c = 2`
  Expected Output:
  ```
  Roots are real and distinct: 2.00
  and 1.00
  ```
- **Test Case 2:**
  Input: `a = 1, b = -2, c = 1`
  Expected Output:
  ```
  Roots are real and equal: 1.00 and
  1.00
  ```
- **Test Case 3:**
  Input: `a = 1, b = 2, c = 5`
  Expected Output:
  ```
  Roots are imaginary: -1.00 + 2.00i
  and -1.00 - 2.00i
  ```

Problem 2: Write a C program to read a student's roll number, name, and marks in three subjects. The program should then calculate the total marks, percentage, and division based on the percentage.

Solution Approach:

1. Prompt the user to input the roll number, name, and marks for three subjects.
2. Calculate the total marks by summing the marks of the three subjects.
3. Calculate the percentage by dividing the total marks by the maximum possible marks (e.g., 300 if each subject is out of 100).
4. Determine the division based on the percentage:
   - First division for percentage >= 60%
   - Second division for percentage >= 50% and < 60%
   - Third division for percentage >= 40% and < 50%
   - Fail if percentage < 40%
5. Print the roll number, name, total marks, percentage, and division.

- **Test Case 1:**
  Input: `Roll No: 101, Name: John, Marks: 85, 78, 92`
  Expected Output:
  ```
  Roll No: 101
  Name: John Doe
  Total Marks: 255
  Percentage: 85.00%
  Division: First
  ```

- **Test Case 2:**
  Input: `CollegeID: 102, Name: Jane Smith, Marks: 55, 60, 58`
  Expected Output:
  ```
  CollegeID: 102
  Name: Jane Smith
  Total Marks: 173
  Percentage: 57.67%
  Division: Second
  ```

Problem 3: Write a C program that reads the temperature in centigrade and displays a suitable message according to the temperature state:

- Temp < 0: "Freezing weather"
- Temp 0-10: "Very Cold weather"
- Temp 10-20: "Cold weather"
- Temp 20-30: "Normal in Temp"
- Temp 30-40: "It's Hot"
- Temp >= 40: "It's Very Hot"

Solution Approach:

1. Prompt the user to input the temperature in centigrade.
2. Use `if-else` statements to determine the temperature state based on the input value.

3. Print the corresponding message based on the temperature range.

Test Cases:

- **Test Case 1:**
  Input: `-5`
  Expected Output:
  `Freezing weather`
- **Test Case 2:**
  Input: `8`
  Expected Output:
  `Very Cold weather`
- **Test Case 3:**
  Input: `15`
  Expected Output:
  `Cold weather`
- **Test Case 4:**
  Input: `25`
  Expected Output:
  `Normal in Temp`
- **Test Case 5:**
  Input: `35` Expected Output:
  `It's Hot`
- **Test Case 6:**
  Input: `42`
  Expected Output:
  `It's Very Hot`

Problem 4: Write a C program to check whether a triangle is Equilateral, Isosceles, or Scalene based on the lengths of its sides.

Solution Approach:

1. Prompt the user to input the lengths of the three sides of the triangle.
2. Use `if-else` statements to check the following conditions:
   o If all three sides are equal, it's an Equilateral triangle.
   o If exactly two sides are equal, it's an Isosceles triangle.
   o If all three sides are different, it's a Scalene triangle.
3. Print the type of triangle.

Test Cases:

- **Test Case 1:**
  Input: `a = 5, b = 5, c = 5`
  Expected Output:
  `The triangle is Equilateral.`
- **Test Case 2:**
  Input: `a = 5, b = 5, c = 7`

Expected Output:
`The triangle is Isosceles.`
- **Test Case 3:**
  Input: `a = 3, b = 4, c = 5`
  Expected Output:
  `The triangle is Scalene.`

Problem 5: Write a C program to check whether a triangle can be formed with the given values for the angles. A triangle is valid if the sum of its angles is equal to 180 degrees.

Solution Approach:

1. Prompt the user to input the three angles of the triangle.
2. Calculate the sum of the three angles.
3. Check if the sum is equal to 180 degrees.
4. Print whether the triangle is valid or not.

Test Cases:

- **Test Case 1:**
  Input: `angle1 = 60, angle2 = 60, angle3 = 60`
  Expected Output:
  `The triangle is valid.`
- **Test Case 2:**
  Input: `angle1 = 90, angle2 = 45, angle3 = 45`
  Expected Output:
  `The triangle is valid.`
- **Test Case 3:**
  Input: `angle1 = 90, angle2 = 50, contextual Example:angle3 = 50`
  Expected Output:
  `The triangle is not valid.`