

2025

OCCUPATIONAL CERTIFICATE: SOFTWARE ENGINEER

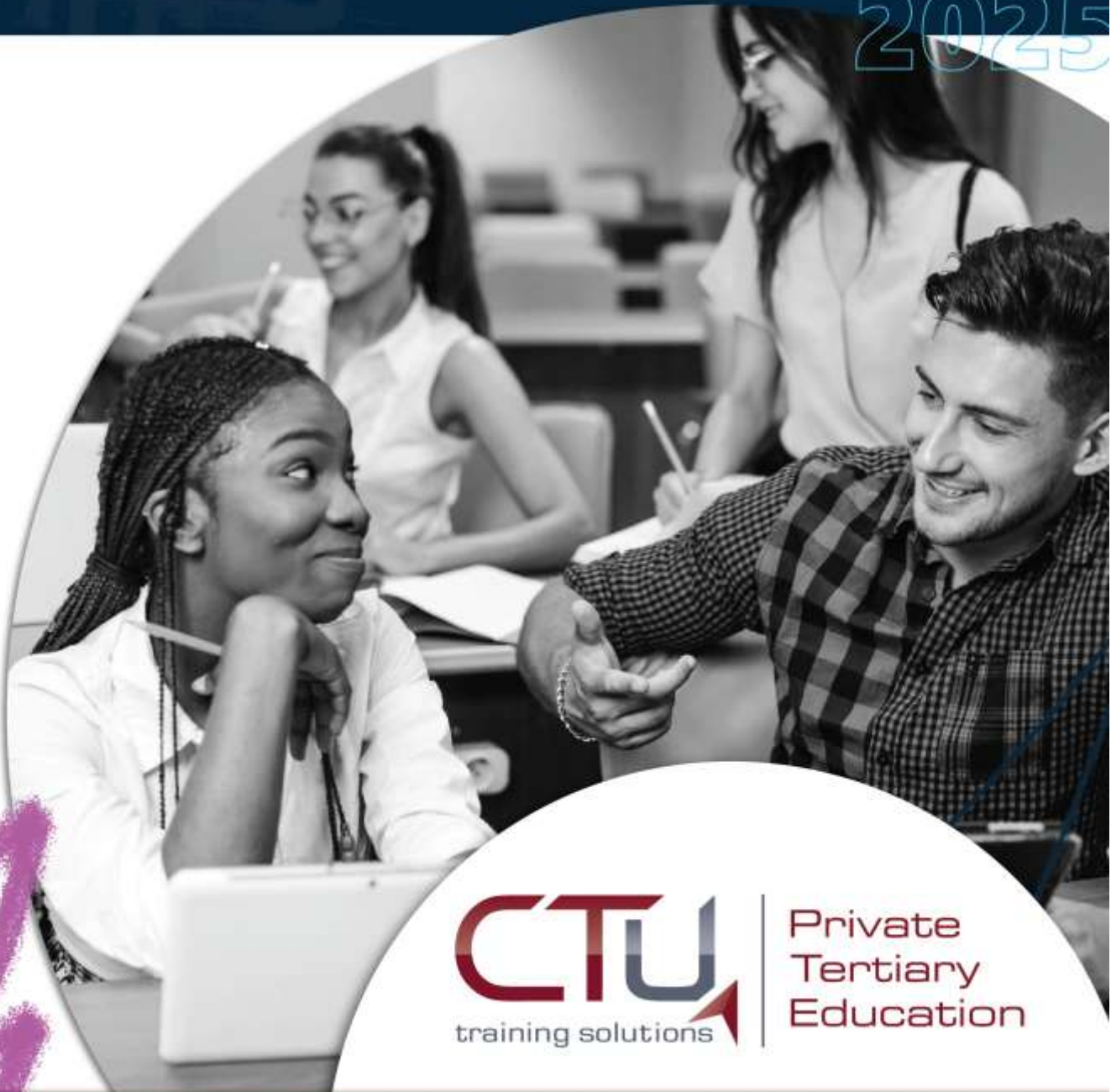
Week Five Practical (C#)

Mathematics

MAT621

2025

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Private
Tertiary
Education

Question: Equation Solver Program Analysis and Application

Total Marks: 100

You are provided with the C# EquationSolver program designed to solve linear equations ($ax + b = 0$) and quadratic equations ($ax^2 + bx + c = 0$). The program prompts the user to select an equation type and input coefficients, then outputs the solutions or appropriate error messages. Answer the following parts, showing all calculations and reasoning where required.

Part A: Linear Equation Solving (30 marks)

Run the EquationSolver program to solve the linear equation $5x - 10 = 0$.

- a. Provide the coefficients you will input into the program. (5 marks)
- b. State the expected solution and verify it by substituting the solution back into the equation. Show your calculations. (10 marks)
- c. Explain what the program would output if you mistakenly entered $a = 0$ and $b = 10$ for a linear equation. Justify your answer using the program's logic. (15 marks)

Part B: Quadratic Equation Solving (40 marks)

2. Run the EquationSolver program to solve the quadratic equation $3x^2 - 6x + 3 = 0$.

- a. Provide the coefficients you will input into the program. (5 marks)
- b. Calculate the discriminant manually and determine the nature of the roots (real and distinct, real and equal, or complex). Show your calculations. (15 marks)
- c. State the program's expected output for this equation and verify one of the roots by substituting it back into the original equation. Show your calculations. (10 marks)
- d. Modify the quadratic equation slightly to produce complex roots (e.g., change one coefficient). Provide the new equation, run it through the program, and state the expected output. (10 marks)

Part C: Error Handling and Edge Cases (20 marks)

3. Test the program's error handling by providing invalid inputs.

- a. Input a non-numeric value (e.g., "abc") for one of the coefficients. Describe the program's

response and explain how it handles this error. (10 marks)

b. For a quadratic equation, input $a = 0$. Explain the program's response and why this is mathematically appropriate. (10 marks)

Part D: Theoretical Understanding (10 marks)

4. Explain why the discriminant ($b^2 - 4ac$) is critical in determining the nature of roots in a quadratic equation. Provide a brief mathematical justification, including how the program uses it to decide the type of roots. (10 marks)

