CSE 330 Assignment 4 [25 marks]

1. Consider a function **f(x) =** $x^3 + x^2 - 4x - 4$.

(a) (5 marks) State the exact roots of f(x) and construct two different fixed point functions g(x) such that f(x) = 0.

(b) (5 marks) Compute the convergence rate of each fixed point function g(x) obtained in the previous part, and state which root it is converging to or diverging.

2. Consider the following function: **f(x) =** $xe^x - 1$.
(a) (5 marks) Find solution of f(x) = 0 up to 5 iterations using Newton's method starting with x_0 = 1.5. Keep up to four significant figures.

(b) (5 marks) Consider the fixed point function, **g(x) =** $\frac{2x+1}{\sqrt{x+1}}$. Show that to be super-linearly convergent, the root must satisfy **x* =** $\frac{-3}{2}$.

3. (a) (5 marks) Consider a cubic function, **f(x) = 2x³ − 2x − 5.** Compute a **superlinearly convergent fixed point function g(x)** for the given function f(x) using **Newton's method.**

CSE 330 Assignment 5 [25 marks]

1. A linear system is described by the following equations:

$$x_1 + 6x_2 + 2x_3 = 10$$
$$3x_1 + 2x_2 + x_3 = 6$$
$$4x_1 + 5x_2 + 2x_3 = 9.$$

Based on these equations, answer the questions below.
(a) [3 marks] From the given linear equations, identify the matrices A, x and b such that the linear system can be expressed as a matrix equation.

(b) [4 marks] Construct the Frobenius matrices $F^{(1)}$ and $F^{(2)}$ from this system.

(c) [3 marks] Compute the unit lower triangular matrix L.

(d) [5 marks] Now find the solution of the linear system using the LU decomposition method. Use the unit lower triangular matrix found in the previous question.

2. A function is given by **f(x) = $e^{0.5x}$ + sin x** which is to be integrated on the interval [0, 2].

a. (2 marks) Evaluate the **exact integral I(f)**.
b. (3 marks) Compute the numerical integral by using the **Newton-Cotes formula with n = 1.**
c. (5 marks) Evaluate the numerical integral $\mathbf{C_{1,4}}$ by using the **Composite Newton-Cotes** formula and also find the percentage relative error.