(1) Define and explain the followings:(15%)
(a) Round-off error, (b) Truncation error, (c) Parallel processing, (d) Gauss-Seidel Iteration method, (e) The successive over relaxation method.

(2) We wish to solve f(x)=0 by using the Newton's iteration.
(a) Derive the expression for the iteration process.(5%)
(b) The iteration process of part (a) can find one root at a time. How would you obtain other roots if f(x)=0 has multiple roots? (4%)
(b) Use graphical representation to indicate three cases that the method would diverge and explain your reasons. (6%)

(3) Use the LU decomposition method to solve the following equations. (20%)

$$\begin{cases} 2x_1 + 3x_2 - x_3 = 5 \\ 4x_1 + 4x_2 - 3x_3 = 3 \\ 2x_1 - 3x_2 + x_3 = 1 \end{cases}$$

(4) We want to use the integral form of the least squares approximations to $f(x) = x^{1.5}$ on $[0,1]$ by $p(x) = a_0 + a_1 x + a_2 x^2$. Find $a_0 = ?$, $a_1 = ?$, $a_2 = ?$ Compare f(x) and p(x) at x=0, x=0.5 and x=1 respectively. (25%).

(5) We want to solve $\begin{cases} 2x_1 + x_2 = 24 \\ x_1 + 2x_2 = -12 \end{cases}$

Using the S.O.R. with a relaxation factor, ω. Find the optimum value for this parameter and evaluate $x^{(1)}, x^{(2)}$, and $x^{(3)}$ using the zero vector as the start vector. (25%)

$$\left(\begin{array}{c} \text{Hint: } x^{(k+1)} = Bx^{(k)} + b' \\ B = (D + \omega L)^{-1}(D - \omega D - \omega U) \\ b' = (D + \omega L)^{-1} \omega b \end{array} \right)$$