

Visvesvaraya National Institute of Technology, Nagpur
Department of Mathematics

Assignment-2 (Nonlinear and linear system of equations) Subject: Numerical Analysis

1. The system of equations $y \cos(xy) + 1 = 0, \sin(xy) + x - y = 0$ has one solution close to $(x, y) = (1, 2)$. Calculate this solution correct to four decimal places.

2. Calculate the solution of the system $x^2 + y^2 = 1.12, xy = 0.23$ correct to three decimal place (take $x_0 = y_0 = 1$).

3. Calculate the solution of the system of equations $x^3 + y^3 = 53, 2y^3 + z^4 = 69, 3x^5 + 10z^2 = 770$ which is close to $(x, y, z) = (3, 3, 2)$.

4. Solve the system using Gauss Elimination method (Check the result by back substitution).

$$\begin{array}{l} 8x_2 + 2x_3 = -7 \quad 6x_2 + 13x_3 = 61 \quad 3.4x_1 - 6.12x_2 - 2.72x_3 = 0 \\ \text{(i) } 3x_1 + 5x_2 + 2x_3 = 8 \quad \text{(ii) } 6x_1 - 8x_3 = -38 \quad \text{(iii) } -x_1 + 1.80x_2 + 0.80x_3 = 0 \\ 6x_1 + 2x_2 + 8x_3 = 26 \quad 13x_1 - 8x_2 = 79 \quad 2.7x_1 - 4.86x_2 - 2.16x_3 = 0 \\ \text{(iv) } 0.0004x_1 + 1.402x_2 = 1.406 \\ 0.4003x_1 - 1.502x_2 = 2.501 \quad \text{(the exact solution is } (10, 1) \text{).} \end{array}$$

5. Solve the linear system by Doolittle's method

$$\begin{array}{l} 5x_1 + 4x_2 + x_3 = 3.4 \\ \text{(i) } 10x_1 + 9x_2 + 4x_3 = 8.8 \quad \text{(ii) } 1.80x_1 + 2.60x_2 = 13.20 \\ 10x_1 + 13x_2 + 15x_3 = 19.2 \quad 0.36x_1 + 3.722x_2 = 12.24 \end{array}$$

6. Solve the linear system by Crout's method

$$\begin{array}{l} x_1 - 4x_2 + 2x_3 = 81 \\ \text{(i) } -4x_1 + 25x_2 + 4x_3 = -153 \quad \text{(ii) } 3x_1 + 2x_2 = 18 \\ 2x_1 + 4x_2 + 15x_3 = 324 \quad 18x_1 + 17x_2 = 123 \end{array}$$

7. Find the inverse of the matrix A by Gauss Jordan method, where $A = \begin{bmatrix} -2 & 4 & -1 \\ -2 & 3 & 0 \\ 7 & -12 & 2 \end{bmatrix}$.

8. Solve the following linear system of equations using Cholesky's method

$$\begin{array}{l} 9x_1 + 6x_2 + 12x_3 = 17.4 \quad 4x_1 + 6x_2 + 8x_3 = 0 \\ \text{(i) } 6x_1 + 13x_2 + 11x_3 = 23.6 \quad \text{(ii) } 6x_1 + 34x_2 + 52x_3 = -160 \\ 12x_1 + 11x_2 + 26x_3 = 30.8 \quad 8x_1 + 52x_2 + 129x_3 = -452 \end{array}$$

9. Show that the LU decomposition method fails to solve the system of equations

$$\begin{array}{l} x_1 + x_2 - x_3 = 2 \\ 2x_1 + 2x_2 + 5x_3 = -3 \\ 3x_1 + 2x_2 - 3x_3 = 6 \end{array}$$