

## DEPARTMENT OF MATHEMATICS, I.I.T. GUWAHATI

### MA 322: Scientific Computing Lab - IV

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1. Starting with  $(1, 1, 1)^T$ , carry out six iterations of Newton's method for finding a root of the non-linear system

$$\begin{cases} x_1 x_2 = x_3^2 + 1, \\ x_1 x_2 x_3 + x_2^2 = x_1^2 + 2, \\ e^{x_1} + x_3 = e^{x_2} + 3. \end{cases}$$

2. Perform two iterations of Newton's method in part (a) and five iterations in part (b): (a). Starting with  $(0, 1)$  (b). Starting with  $(-1, 4)$

$$(a). \quad \begin{cases} 4x_1^2 - x_2^2 = 0, \\ 4x_1 x_2^2 - x_1 = 1. \end{cases} \quad (b). \quad \begin{cases} 1 + x^2 - y^2 + e^x \cos(y) = 0, \\ 2xy + e^x \sin(y) = 0. \end{cases}$$

3. Use Newton's method to find a solution to the following nonlinear systems in the given domain. Iterate until  $\|\mathbf{x}^{(k)} - \mathbf{x}^{(k-1)}\|_\infty < 10^{-6}$ .

$$\begin{cases} 6x_1 - 2\cos(x_2 x_3) - 1 = 0, \\ 9x_2 + \sqrt{x_1^2 + \sin(x_3)} + 1.06 + 0.9 = 0, \\ 60x_3 + 3e^{-x_1 x_2} + 10\pi - 3 = 0. \end{cases}$$

Use  $\mathbf{x}^{(0)} = (0, 0, 0)^T$ .

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