# HARARE INSTITUTE OF TECHNOLOGY

ICS 226/ISE225

School of information Sciences and Technology

**B.Tech Computer Sciences and B.Tech Software Engineering**

ICS 226/ISE225: Numerical Analysis

ASSIGNMENT 1, Due Date 23-03-2018

Time : – hours

Candidates should attempt **ALL** questions $[60 Marks]$.

**A1.** (a) State the theorem for the loss of significance for the subtraction of two floating numbers $x$ and $y$ such that $x > y > 0$. [4]

(b) How many significant figures are lost in the subtraction of 10.17578125 and 10.25390625? [6]

(c) The formulae for solving the quadratic equation $ax^2 + bx + c = 0$ for $a \neq 0$ is

$$x_1 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}, \text{ and } x_2 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}. \quad (1)$$

(i) Use this formula, on your machine or calculator, to solve the equation

$$x^2 - 100000x + 1 = 0$$

. [3]

(ii) Discuss any loss of significance that occurs in the solution of the equation. [3]

(iii) The formulas in (1) can be rearranged into

$$x_1 = \frac{-2c}{b - \sqrt{b^2 - 4ac}}, \text{ and } x_2 = \frac{-2c}{b + \sqrt{b^2 - 4ac}}. \quad (2)$$

Solve the equation in (c)(i) by using these new formulas for $x_1$ and $x_2$ and comment on the loss of significance. [4]

**A2.** Find the solution for $f(x) = e^x + x^4 + x - 2 = 0$, using the Bisection method. Do five iterations. [10]

**A3.** (a) Verify that when the Newton-Raphson method is used to compute $\sqrt{R}$, then the sequence of iterates is defined by

$$x_{n+1} = \frac{1}{2}\left(x_n + \frac{R}{x_n}\right)$$

[4]

(b) Use an iterative process to evaluate $(69)^{\frac{1}{2}}$ correct to 6 decimal places. [4]

**A4.** (a) Construct the Newton Polynomial $P_4(x)$ for the points $(x, \cos(x))$, $x = 0, 1, 2, 3, 4$. [2]

(b) Use the divided difference table to form the interpolating polynomial of degree 4. Round off values to 6 decimal places. [8]

(c) Find the approximate value of $P_4(x)$ at $x = 2.6$. [2]

**A5.** Write pseudo code that generates Newton's interpolation divided-differences. [10]

**END OF QUESTION PAPER**