

Student ID:

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

Quiz no. 1

DURATION: 30 MIN

Summer Semester 2020-2021

FULL MARKS: 15

**Math 4641: Numerical Methods**

Figures in the right margin indicate marks.

1. i) When we use a calculator to find the square root of a positive number  $R$ , then the calculator actually performs some sort of numerical method to find it. One such method is the **Newton-Raphson** method. Prove that the **Newton-Raphson** equation for finding the square root of  $R$  is:

$$X_{i+1} = \frac{1}{2} \left( X_i + \frac{R}{X_i} \right)$$

- ii) Suppose you are trying to find the square root of **10**. If you directly use your calculator, you will get the result as **3.16228**. Simulate how the calculator will find this value by using Newton-Raphson method for at least **3** iterations taking an initial guess of  $X_0 = 5$ . Show the absolute relative approximate error at every iteration.

2. What are the different ways truncation error may be introduced?
3. Calculate the approximate derivative of  $\frac{e^x}{1+x}$  using  $h=0.02$  and  $h=0.01$  and find the absolute relative approximate error. How many significant digits can you trust in this approximate solution?
4. Explain how the False Position method improves over the Bisection method.

$$\begin{aligned}x &= \sqrt{R} \\x^2 &= R \\x^2 - R &= 0\end{aligned}$$

$$f(x) = x^2 - R$$