

University of Asia Pacific
Department of Computer Science & Engineering
Mid-Semester Examination Fall 2020
Program: B.Sc. Engineering (3rd Year/2nd Semester)

Course Code: CSE 313/ CSE 209* **Course Title: Numerical Methods** **Credit: 3.00**
Time: 1 Hour (Extra 20 Minutes for submission) **Full Marks: 60**

Instructions: Answer **all** questions. All questions are of equal value. Part marks are shown in the margins.
*Self-study.

- Q. 1 a) What is relative true error? How the relative true error is calculated? {5}
- b) Use forward divided difference approximation of the first derivative of $f(x) = x^3 \ln(x)$ to calculate the derivative at $x = \odot$ with a step size of 2. Find the exact value and absolute relative true error. Use four decimal digit arithmetic to find a solution. {15}
- Note:** Please replace the value of x (i.e. \odot) with the multiplication of your roll number (e.g. xxxxxx51) by 0.2 (i.e. 51×0.2).
- Q. 2 a) What are the steps to apply bisection method to find the root of the equation $f(x) = 0$? {5}
- b) Assuming an initial bracket of $[3, \odot]$, what would be the second (at the end of 2 iterations) iterative value of the root of the function $f(x) = \frac{x}{2} - \sqrt[3]{(x+1)}$ using the bisection method. Find the absolute relative approximate error and the number of significant digits at least correct at the end of each iteration. Use four decimal digit arithmetic to find a solution. {15}
- Note:** Please replace the smile symbol (i.e. \odot) given in the initial bracket with the summation of 3 and the multiplication of your roll number (e.g. xxxxxx51) by 0.2 i.e. $3 + (51 \times 0.2) = \odot$.
- Q. 3 a) What do you mean by significant digits? Briefly explain. {5}
- b) Use Newton-Raphson method to estimate the root of $f(x) = x^{4/3} + x - 1$. Conduct 3 iterations assuming that the root exists in the interval of $[0.2, \odot]$. Find the absolute relative approximate error and the number of significant digits at least correct at the end of each iteration. Use four decimal digit arithmetic to find a solution. {15}
- Note:** Please replace the smile symbol (i.e. \odot) given in the interval with the multiplication of your roll number (e.g. xxxxxx51) by 0.2 (i.e. 51×0.2).

OR,

- a) Write down the advantages and drawbacks of Newton-Raphson method. {5}
- b) One of the UAP CSE students wishes to find a root of the function $f(x) = x^{7/2} - x - 1$. He/she will use $x_i = \text{☺}$ and $x_{i-1} = 0.1$ as initial approximations. He/she will halt after a maximum of $N=3$ iterations. Consider four decimal digit arithmetic to find a solution using secant method. Find the absolute relative approximate error and the number of significant digits at least correct at the end of each iteration. {15}
- Note:** Please replace the smile symbol (i.e. ☺) used as a value of x_i with the multiplication of your roll number (e.g. xxxxxx51) by 0.2 (i.e. 51×0.2).