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 Department of Computer Science & Engineering
Mid Term Examination Spring 2022
CSE 4745 Numerical Methods
 Total Marks: 30 Time: 90 Minutes

[Answer *all* the *three* questions. Figures in the right-hand margin indicate full marks.]

- | 1.a) | What do you mean by <i>numerical computing</i> ? State the four characteristics of numerical computing. | 2 | CO1 | | | | | | | | | | | | |
|-------|---|------|------|------|------|------|------|-------|----|----|----|----|----|--|--|
| b) | Write short notes on:
i) Conversion errors ii) Roundoff errors iii) Truncation errors | 3 | CO1 | | | | | | | | | | | | |
| c) | Describe the <i>banker's rounding rule</i> with examples. Use <i>banker's rounding rule</i> to round off the following numbers to four significant figures -
i) 38.46735 ii) 0.700156 iii) 0.0022213 iv) 19.245101 | 3 | CO1 | | | | | | | | | | | | |
| OR | | | | | | | | | | | | | | | |
| | What do you mean by <i>significant digits</i> ? How to count significant digits of a number? Use <i>banker's rounding rule</i> to round off the following numbers to four significant figures -
i) 38.46435 ii) 0.700356 iii) 0.0022218 iv) 19.275101 | | | | | | | | | | | | | | |
| d) | What do you mean by <i>absolute error</i> and <i>relative error</i> ? If $X = 0.430958$ is rounded off to four significant figures compute the absolute error and relative error in X. | 2 | CO2 | | | | | | | | | | | | |
| 2.a) | | | | | | | | | | | | | | | |
| | Evaluate the polynomial $f(x) = x^4 - 2x^3 + 5x^2 - 7x + 10$ using Horner's rule at $x = V$. [V means the <i>last digit</i> of your ID number. Example: for C171017, $x = 7$] | 1.5 | CO2 | | | | | | | | | | | | |
| b) | Derive the <i>Newton - Raphson formula</i> . Write the advantages and disadvantages of Newton - Raphson method | 2.5 | CO1 | | | | | | | | | | | | |
| c) | Find the root of the equation $x^3 - 9x + 1 = 0$, correct to two decimal places, by using the <i>bisection method</i> . | 4 | CO2 | | | | | | | | | | | | |
| OR | | | | | | | | | | | | | | | |
| | Find the root of the equation $x^3 - 6x + 4 = 0$, correct to two decimal places, by using the <i>secant method</i> . | | | | | | | | | | | | | | |
| d) | What is <i>synthetic division</i> ? Find the <i>quotient polynomial</i> $q(x)$ such that $p(x) = (x - 2) q(x)$ where the polynomial $p(x) = x^3 - 6x^2 + 11x - 6 = 0$ has a root at $x = 2$. | 2 | CO2 | | | | | | | | | | | | |
| 3.a) | | | | | | | | | | | | | | | |
| | What do you mean by <i>interpolation</i> ? | 1 | CO3 | | | | | | | | | | | | |
| b) | Show that $\delta = E^{1/2} - E^{-1/2}$ and $\mu = \frac{1}{2}(E^{1/2} + E^{-1/2})$. | 2 | CO4 | | | | | | | | | | | | |
| c) | Derive the <i>Newton's forward interpolation formula</i> . | 3 | CO3 | | | | | | | | | | | | |
| OR | | | | | | | | | | | | | | | |
| | Derive the <i>Newton's divided difference formula</i> | | | | | | | | | | | | | | |
| d) | The following table gives the sales of a software firm for the five years. | 4 | CO4 | | | | | | | | | | | | |
| | <table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th>Year</th> <th>2008</th> <th>2010</th> <th>2012</th> <th>2016</th> <th>2020</th> </tr> </thead> <tbody> <tr> <td>Sales</td> <td>40</td> <td>43</td> <td>48</td> <td>52</td> <td>58</td> </tr> </tbody> </table> | Year | 2008 | 2010 | 2012 | 2016 | 2020 | Sales | 40 | 43 | 48 | 52 | 58 | | |
| Year | 2008 | 2010 | 2012 | 2016 | 2020 | | | | | | | | | | |
| Sales | 40 | 43 | 48 | 52 | 58 | | | | | | | | | | |
| | (in millions) | | | | | | | | | | | | | | |
| | Estimate the sales for the year 2009 [if the <i>last digit</i> of your ID is <i>even</i>] / 2018 [if the <i>last digit</i> of your ID is <i>odd</i>] using a <i>suitable interpolation formula</i> . | | | | | | | | | | | | | | |