NUMERICAL ANALYSIS

Assignment -3 (week 3)

Total Marks - 25

Posted on - 7/8/2017 (Monday);

To be submitted on or before-16/8/2017 (Wednesday), 23.59 hours.

Problems on

- Inverse interpolation
- Numerical Differentiation

INSTRUCTIONS

- This is a question paper cum answer booklet.
- Take a print out of this.
- Present the details of the computations of the solution of each problem **which you will have to show** in the space provided at the bottom of the page.
- Fill in the answers in the space provided below each question.
- Scan the booklet and submit it as a pdf file before the deadline for evaluation.

1. Use the forward difference and backward difference formulas:
$f'(x_0) = \frac{f(x_0+h)-f(x_0)}{h} - \frac{h}{2}f''(\xi_1)$ and $f'(x_0) = \frac{f(x_0)-f(x_0-h)}{h} + \frac{h}{2}f''(\xi_2)$ to determine each missing entry in the following table:

x	0.5	0.6	0.7
$f(x)$	0.4794	0.5646	0.6442
$f'(x)$	?	?	?

Fill in the blanks.

(a)$f'(0.5) \simeq$ _____, (b)$f'(0.6) \simeq$ _____, _____,

(c)$f'(0.7) \simeq$ _____ . (4 marks)

Show your work for the solution of problem 1 in the space provided below.

2. Using the following table of values of $f(x)$, estimate $f'(2.0)$ with five-point midpoint formula

x	1.8	1.9	2.0	2.1	2.2
$f(x)$	10.889	12.703	14.778	17.148	19.855

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Fill in the blank: $f'(2.0) \simeq$ _____ . (3 marks)

Show your work for the solution of problem 2 in the space provided below.

3. Use the following five-point end point formula
$f'(x_0) = \frac{1}{12h}[-25f(x_0) + 48f(x_0 + h) - 36f(x_0 + 2h) + 16f(x_0 + 3h) - 3f(x_0 + 4h)] + \frac{h^4}{5}f^{(5)}(\xi)$ where $x_0 < \xi < x_0 + 4h$, determine $f'(1.8)$, taking $h = 0.1$ from the following table of values of $f(x)$.

x	1.8	1.9	2.0	2.1	2.2
$f(x)$	10.889	12.703	14.778	17.148	19.855

Fill in the blank:
$f'(1.8) \simeq$ _____. (3 marks)

Show your work for the solution of problem 3 in the space provided below.

4. Use the most accurate three-point formula to determine each missing entry in the folowing table:

x	1.1	1.2	1.3	1.4
$f(x)$	9.025	11.023	13.463	16.444
$f'(x)$	?	?	?	?

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Fill in the blanks:
(a)$f'(1.1) \simeq$ _____, (b)$f'(1.2) \simeq$ _____,

(c)$f'(1.3) \simeq$ _____, (d)$f'(1.4) \simeq$ _____ . (8 marks)

Show your work for the solution of problem 4 in the space provided below.

5. A differential rule of the form $f'(x_0) = \alpha_0 f_0 + \alpha_1 f_1 + \alpha_2 f_2$, where $x_1 = x_0 + kh$, $k = 0, 1, 2$ and $f_k = f(x_k)$, $k = 0, 1, 2$ is given. Find the values of α_0, α_1 and α_2 so that the rule is exact for polynomials of degree ≤ 2. Find the error.
Fill in the blanks:
(a) $\alpha_0 =$ _____ , (b) $\alpha_1 =$ _____ , (c) $\alpha_2 =$ _____ .
(d) If the error term is given by $Ch^{\alpha} f_0^{(\beta)}(\xi)$, then

$|C| =$ _____, $\alpha =$ _____ , $\beta =$ _____ .

(e) $f'(x_0) =$ _____ . (7 marks)

Show your work for the solution of problem 5 in the space provided below.