



RAJARATA UNIVERSITY OF SRILANKA

FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree

Second Year Semester II Examination – April / May 2016

MAA 2203 – Numerical Analysis I1

Answer four Questions only.

Time allowed: Two Hours

Calculators will be provided.

1.

I. Calculate the $f[x_1, x_2, x_3, x_4]$ divided difference of $\frac{1}{x^2}$, based on the points x_1, x_2, x_3, x_4 .

II. Construct the difference table for the sequence of values

$f(x) = (0, 0, 0, \epsilon, 0, 0, 0)$, where ϵ is an error. Also show that

a. The error spreads and increase in magnitude as the order of differences is increased.

b. The errors in each column have binomial coefficients.

2.

I. The following data for a function $f(x, y)$ is given :

$y \backslash x$	0	1
0	1	1.414214
1	1.732051	2

Find $f(0.25, 0.75)$, using linear interpolation.

II. Find the natural cubic spline interpolate to f at the points $x_0 = 0$, $x_1 = 1$, $x_2 = 2$ and $x_3 = 3$ where $f_0 = 0$, $f_1 = 2$, $f_2 = 1$ and $f_3 = 0$.

[P.T.O]

3.

- I. We are given the following values of a function of the variable t :

t	0.1	0.2	0.3	0.4
f	0.76	0.58	0.44	0.35

Obtain a **least squares fit** of the form $f(t) = ae^{-3t} + be^{-2t}$.

- II. Obtain the **Chebyshev polynomial approximation** of second degree to the function $f(x) = x^3$ on $[0,1]$.

4.

- I. Given the following values of $f(x)$ and $f'(x)$

x	-1	0	1
$f(x)$	1	1	3
$f'(x)$	-5	1	7

Estimate the value of $f(-0.5)$ and $f(0.5)$ using the **Hermite interpolation**.

The exact values are $f(-0.5) = \frac{33}{64}$ and $f(0.5) = \frac{97}{64}$.

- II. Obtain the **piecewise quadratic interpolating polynomial** for the function $f(x)$ defined by the data.

x	-3	-2	-1	1	3	6	7
$f(x)$	369	222	171	165	207	990	1779

Hence find an approximate value of $f(-2.5)$ and $f(6.5)$.

5.

- I. The following values of a function $f(x)$, have been obtained experimentally

x	-1	2	4
$f(x)$	7.5	9.0	2.2

Use **Lagrange method** to find a quadratic approximation to $f(x)$. Hence estimate $f(0)$ and the positive value of x for which $f(x) = 0$. Comment on the likely reliability of these estimates.

II. Two estimate of the original $\int_{0.2}^1 \left(\frac{1}{2}\right)^x dx$ are given in the table be [P.T.O]

h	Mid point	Trapezium
0.8	0,52780316	0.54822023
0.4		

- Obtain the two missing values in the table.
- Hence obtain two Simpson rules estimates of the method.

Give the value of the integral to the accuracy that you consider to be justified from your answers.

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