INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

MA635P-Scientific Programming Laboratory

Lab Exercise-3 (30 Marks) Deadline: 23 January 2025, 5:00 PM

Group Exercise

1. Create an algorithm for Newton's interpolation method. [2.5]
2. Create an algorithm for Newton's backward/forward difference formula. [2.5]

Individual Exercise

3. Write a Python code to compute and plot the first 6 Taylor Polynomials with $f(x)$ [5]
   (a) about $x_0 = 1$ for $f(x) = 1/x$
   (b) about $x_0 = 0$ for $f(x) = e^x$
4. Write a Python code for the developed algorithm for Newton's divided difference formula, Newton's interpolating polynomial, Newton's forward/backward difference formula including ε_t and test all examples of Lecture 9 and 10. [5]
5. Using Newton's divided difference formula and Newton's interpolating polynomial, Compute $f(2.5)$, $f(1.25)$ and $f(3.25)$ using $P_3(x)$ and then compute $f(2.5)$ using $P_4(x)$. [5]

x	1	1.5	2	3	3.5	4
$f(x)$	0.0	0.17609	0.30103	0.47712	0.54407	0.60206

6. Based on an experiment on heated plate, temperatures are measured at various points as given in below table. Estimate the temperature at $(x, y) = (4, 3.2)$ and $(x, y) = (4.3, 2.7)$ using Newton's interpolating polynomial $P_4(x)$. [5]

y	$x = 0$	$x = 2$	$x = 4$	$x = 6$	$x = 8$
0	100	90	80	70	60
2	85	64.49	53.5	48.15	50
4	70	48.9	38.43	35.03	40
6	55	38.78	30.39	27.07	30
8	40	35	30	25	20

7. Using Newton's forward/backward difference formula, compute $\cosh(0.56)$ and ε_t. [5]

x	0.5	0.6	0.7	0.8
$f(x)$	1.127626	1.185465	1.255169	1.337435