INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

DEPARTMENT OF MATHEMATICS

MA 322: SCIENTIFIC COMPUTING

Semester–II, Academic Year 2022-23

Lab – 4

L4_1. Consider the data Approximate $f(0.5)$ and $f(1.5)$. Do your approximation satisfy $f(x) \geq$

x	0	1	2	2.5	3	3.5	4
$f(x)$	2.5	0.5	0.5	1.5	1.5	1.125	0

0, $\forall x \in [x_0, x_5]$ and $f(x_0) \geq f(x)$, $\forall x \in [x_0, x_5]$?

Hint: Use graphical representation of interpolated $f(x)$.

L4_2. Consider the following data: Approximate $f(6)$ using (a) Newton divided-difference,

x	-10	-7	-1	3	5	5.5	7.25
$f(x)$	-4	10	2.1	-1.7	10	-2.25	1.125

(b) Lagrange's and (c) Newton forward-divided difference interpolation. Compare your results.

L4_3. Determine where does the surfaces

$$z = x^2 + y^2 - 2x - 2y + 1$$
$$z = x + y - 2xy$$

intersect with the xy-plane.

L4_4. Find the points of interaction of a circle of radius 2 and center at (0, 0) with the unit hyperbola.

L4_5. Solve the systems $x^2+xy^3 = 9$, $3x^2y-y^3 = 4$. Use the initial guesses $(x_0, y_0) = (1.2, 2.5)$, $(-2, 2.5)$, $(-1.2, -2.5)$, and $(2, -2.5)$. Determine the number of iteration required, and the speed of convergence.

L4_6. For a function $f(x)$, we define the forward difference as $\Delta f = f(x + h) - f(x)$, and the backward difference as $\nabla f = f(x) - f(x - h)$ for some $h > 0$. Calculate the forward and backward differences for $f(x)$ given below:

x	-10	-7	-4	-1	2	5	8	11
$f(x)$	-2	-10	15	20	-17	11	-2.25	0.125

(a) Approximate $f(9)$ using (i) Newton forward interpolation and (ii) Newton backward interpolation. Compare the results.

(b) Approximate $f(-8)$ using (i) Newton forward interpolation and (ii) Newton backward interpolation. Compare the results.