SAPTHAGIRI NPS UNIVERSITY

Mathematics Department

II SEMESTER
Module 4-Numerical Methods – I

Two Marks Questions:

1. Define interpolation and Extrapolation.
2. Define forward difference operator.
3. If $x_0 = 0, x_1 = 2, f(x_0) = -4$ and $f(x_1) = 2$ then find first Newton's divided difference.
4. Use the Newton-Raphson method to find the root of the equation $f(x) = x^3 - 4x - 9$ with an initial value $x_0 = 3$. Perform one iteration.
5. If $f(x) = x^3 - x + 2$ then find the values of $f(0), f(1), f(-1)$and $f(2)$.
6. Write the formula for Bisection method.
7. Find the roots of the equation $x^3 - 9x + 1 = 0$ by Regula Falsi Method perform one iteration.
8. Find x_1 of $3x = \cos x + 1$ using Newton's Raphson Method.
9. Find x_1 using Bisection Method for the equation $f(x) = xe^x - 1$.
10. Find the first-order divided difference for the function $f(x) = x^2$at $x = 1$ and $x = 2$.
11. Define Algebraic Equations and give examples.
12. Define Transcendental Equations and give example.
13. Write the formula for Regula-Falsi Method
15. Write the formula for Newton-Raphson method.
16. Write the formula for Newton-Gregory forward Interpolation Formula.
17. Write the formula for Newton-Gregory backward Interpolation Formula.
18. Write the formula for Newton Divided Difference Formula.
19. Determine the interval that contains the root of the equation$x^3 + x^2 + 3x + 4 = 0$.
20. Perform one iteration of the Newton-Raphson method to approximate the cube root of 37, using 3 as initial value.

Bisection Method

1. Find the root of the equation $f(x) = 2x^3 - 2x - 5$ by bisection method.
2. Find the root of the equation $f(x) = x^2 - 4x - 9$ by bisection method.
3. Find the root of the equation $f(x) = x^3 - 4x + 1$ by bisection method.

Regula Falsi method

1. Use Regula-Falsi method to find a real root of $x^3 - 4x - 9 = 0$ correct to three decimal places

2. Find the real root of the equation $x log_{10} x - 1.2 = 0$ that lies between 2 and 3 correct to three decimal places by Regula-Falsi method

3. Find a real root of $x^3 - 5x - 7 = 0$ by Regula-Falsi method. Carry out three iterations.

4. Show that a real root of the equation $tanx + tanhx = 0$ lies between 2 and 3. Then apply the Regula-Falsi method to find the third approximation

5. Using the Regula-Falsi method, find the root of the equation $xe^x = cosx$ that lies between 0.4 and 0.6. Carry out four iterations.
6. Use Regula-Falsi method to find a real root of the equation $2x - log_{10}x = 7$ which lies between 3 and 4.
7. Find a real root of the equation $cosx - 3x + 1 = 0$, correct to 3 decimal places using Regula-Falsi method.

8. Find the real root of the equation $cosx = xe^x$ to four decimal places using Regula-falsi method

9. Find the real root of the equation $xe^x = 2$ by using Regula-falsi method .

10. Find the real root of the equation $x^3 - 2x - 5 = 0$ which lies between (2, 3) by using Regula-Falsi Method.
11. Find the real root of the equation $x^3 - 3x + 4 = 0$ which lies between (-3, -2) by using Regula-Falsi Method.

Newton Raphson Method

1. Using Newton –Raphson method, find the root of $x\ log_{10}x = 1.2$ near 2.5. Carry out 3 Iterations
2. Find a real root of the equation $x\ sinx + cos\ x = 0$, near $x = \pi$ correct to four decimal places. Using Newton – Raphson.
3. Find a root of the equation $tanx = x$ which is near to $x = 4.5$ using Newton's- Raphson method.
4. Find the real root of the equation $xe^x = 2$ near x=0.5 correct to three decimal places using Newton- Raphson Method.
5. Find the root of the equation $x^3 + 5x - 11 = 0$ nearer to 1.5, up to fouth decimal places using Newton- Raphson Method

Finite differences

1. Find $y(1.4)$ using Newton's Forward interpolating formula

x	1	2	3	4	5
$y = f(x)$	10	26	58	112	194

2. Use Newton's backward interpolation formula to find f(410)

x	100	150	200	250	300	350	400
f(x)	10.63	13.03	15.03	16.81	18.42	19.90	21.27

3. The Population of a town is given by the table

Year	1951	1961	1971	1981	1991
Population in thousands	19.19	39.65	58.81	77.21	94.64

Using Newton's forward and backward interpolation, calculate increase population in 1955 to 1985.

4. From the following table, estimate the number of students who obtained marks b/w 40 & 45

Marks	30 – 40	40 - 50	50 – 60	60 – 70	70 - 80
No. of Students	31	42	51	35	31

5. The area A of a circle corresponding to the diameter (D) is given below:

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to the diameter 105 by using appropriate interpolation formula.

6. Estimate the probable number of persons in the age group 20 to 25 from the following data

Age group	Under 10	10-20	20-30	30-40	40-50
Number of persons	20	45	115	210	115

7. Given f (0) = 1, f(1) = 3, f(2) = 7, f(3) = 13. Find f(0.1) and f(2.9) using Newton Interpolation formula.
8. For the following data calculate the differences and obtain backward difference interpolation polynomial. Hence find f(0.35)

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.0	2.28

9. Use Newton's Backward interpolation formula and find interpolating polynomial. Hence find f (12.5)

x	10	11	12	13
f(x)	22	24	28	34

10. Given that $\sin 45^0 = 0.7071$, $\sin 50^0 = 0.7660$, $\sin 55^0 = 0.8192$, $\sin 60^0 = 0.8660$. Find $Sin\ 52^0$ UsingNewton's forward interpolation formula.

11. Find $y(8)$ from y (1) =24, y(3)=120, y(5)=336 ,y(7) =720 by using Newton's backward difference formula.
12. Using Newton's forward difference formula find f(3) given that,

x	0	2	4	6	8	10
f(x)	0	4	56	204	496	980

13. Use an appropriate interpolation formula to compute f(42) using the following data:

x	40	50	60	70	80	90
f(x)	184	204	226	250	276	304

Newton's Divided Difference

1. Fit an interpolating formula for the data $u_{10} = 355\ u_0 = -5\ u_8 = -21\ u_1 = -14$ $u_4 = -125$.
2. Find the equation of the polynomial which pass through the point (4, -43), (7, 83), (9, 327), (12,1053) By using Newton's divided difference interpolation.
3. If f (1) =4, f (3) = 32, f (4) = 55, f (6) = 119; find interpolating polynomial by Newton's divided difference formula.
4. Use Newton's divided difference formula and find f (4), given the data

x	0	2	3	6
f(x)	-4	2	14	158

5. Using Newton's divided difference interpolation formula, find the interpolating polynomial

x	0	1	2	3	4	5
$f(x)$	3	2	7	24	59	118

6. Using Newton's divided difference formula, find f(8), f(15) from the following data:

x	4	5	7	10	11	13
f(x)	48	100	294	900	2028	1210

7. Determine f(x) as a polynomial in x for the following data using Newton's divided difference formula:

x	-4	-1	0	2	5
y	1245	33	5	9	1335

8. Construct an interpolating polynomial for the data given below using Newton's divided difference formula:

X	2	4	5	6	8	10
f(x)	10	96	196	350	868	1746