Heritage Institute of Technology
Paper Name:-Probability and Numerical Methods Lab
Paper Code:- MATH2212

1. Write a program in 'C' to solve a system of linear equations by ***Gauss – Seidel's*** method. Use your program to find the solution to the following system of linear algebraic equations and Take the tolerance limit as **.00001(i.e correct upto four decimal places)**

$$9x_1 - 3x_2 + 2x_3 = 20$$
$$4x_1 + 10x_2 - x_3 = 33$$
$$x_1 + 5x_2 + 4x_3 = 9$$

Output:- ***x1=3.094538 x2=1.964285 x3=-0.978991 No of iterations= 12***

2. (a) Write a program in 'C' to approximate a definite integral by ***Simpson's $\frac{1}{3}$ rd rule.*** Test your program with the definite integral $\int_0^1 \frac{sinx}{1+x^3} dx$, $[Take\ number\ of\ subintervals\ n = 10]$

Output:- ***Value of the integration 0.347000***

(b) Write a program in 'C' to approximate a definite integral by ***Trapezoidal Rule.***
Calculate the value of the integral $\int_0^6 \frac{e^x}{1+x^4} dx$, $[Take\ number\ of\ subintervals\ n = 6]$

Output:- ***Value of the integration 3.143786***

3. Write a program in 'C' to implement the ***Newton's Forward Interpolation*** formula. Hence find **f(0.5)** from the following set of data.

x:	0	1	2	3	4
$y = f(x)$:	1	1.5	2.2	3.1	4.3

Output:-
The Forward Difference Table is:

```
0.00000  1.00000  0.50000  0.20000  -0.00000  0.10000
1.00000  1.50000  0.70000  0.20000  0.10000
2.00000  2.20000  0.90000  0.30000
3.00000  3.10000  1.20000
4.00000  4.30000
```

The required interpolated value of f(0.500)=1.221094

4. (a) Write a program in 'C' to implement ***Runge-kutta* method of order 4.**
Hence calculate the value of y at the point x=1.5 of the following differential equation.

$$\frac{dy}{dx} = xe^x + 2y, given\ that\ at\ x = 1, y = 1, and\ h = 0.1$$

Output:- ***y(1.5)=6.292050***

(b) Write a program in 'C' to implement ***Euler's* method.**

$$\frac{dy}{dx} = 3xlogx + y^2, given\ that\ at\ x = 1, y = 1.2, and\ h = 0.1$$

Hence calculate the value of y at the point x=1.5 of the following differential equation.

Output:- ***y(1.5)=2.990168***

(c) Write a program in 'C' to implement ***Modified Euler's* method.**
Hence calculate the value of y at the point x=2 of the following differential equation.

$$\frac{dy}{dx} = x^2 * y, given\ that\ at\ x = 1, y = 1, and\ h = 0.1$$

Output:- ***y(2)=10.693639***

5.(a) Write a program in 'C' to find a real root of a algebraic equation by ***Regula-Falsi method***.
Find a real positive root of the equation $x^3 tanx + x^2 - 2x - 5 = 0$

(b) Write a program in 'C' to find a real root of a algebraic equation using ***Newton-Raphson*** **method**.
Hence find a real positive root of the equation $x^6 + 2x^4 - x^3 - 1 = 0$
For both the problem **5(a) and 5(b)** take tolerance limit **0.00001** or correct upto **4 decimal places**.

Output:- 5.(a) ***Regula Falsi Method 3.18030*** 5.(b) ***Newton raphson Method 0.882789***

6. Write a program in 'C' to solve a system of linear equations by ***Gaussian Elimination*** method. Use your program to find the solution to the following system of linear algebraic equations:

$$9x_1 + 4x_2 + 2x_3 = 26$$
$$6x_1 + 3x_2 + x_3 = 20$$
$$2x_1 + 2x_2 + 6x_3 = 10$$

Output:- ***Gaussian Elimination Method :-***
Upper triangular matrix:
9.000000 4.000000 2.000000 26.000000
0.000000 0.333333 -0.333333 2.666666
0.000000 0.000000 6.666667 -4.666667
x[3]=-0.700000 x[2]=7.300000 x[1]=-0.200000

7. . Write a program in 'C' to implement the ***Lagrange's Interpolation*** formula.
Test your program to find **f(6.60)** from the following table using Lagrange's Interpolation.

x	6.55	6.58	6.59	6.61	6.63
$y = f(x)$	2.8156	2.8182	2.8189	2.8202	2.8224

Output:- ***f(6.60)=2.819531***

8.(a) Find the ***Mean, Median , Mode and Standard Deviation*** of the following grouped data:

Variate(x):	20-30	30-40	40-50	50-60	60-70
Frequency(f):	3	5	20	10	5

Output:- ***Mean= 47.093021 Median= 46.75000 Mode= 46.0000 S.D.= 10.243124***

(b) Find the ***Mean ,Median, Mode and Standard deviation*** of the following ungrouped data:
36, 38, 9, 58, 38, 61 , 58, 38, 5 ,58 , 96 , 102 ,38 ,76 ,91
Output:- ***Mean= 53.466667 Median= 58.00000 Mode= 38.0000 S.D.= 28.625086***

9. Write a program in 'C' to determine the ***Correlation Coefficient*** between the following two random variables and the ***Regression equation of y on x.***

Variable(x):	-3	-2	-1	0	1	2	3
Variable(y):	9	4	1	0	1	4	8

Output:- ***sdx=2.000000 sdy=3.270149***
cov=-0.428572 correlation coefficient is=-0.065528
regression line Y on X is (y-3.857143)=-0.107143(x-0.000000)