Lab Submission Problems for NMCP Lab- 4th Sem., 2023

Do the following programs using 'C' language, draw the flow chart and also compare the results by Numerically solving each problem. The submission should be hand written only.

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1.	*Find the root of the equation $xe^x = \cos x$ in the interval (0, 1) using Regula-Falsi method correct to four decimal places. Write its computer programme in 'C' language.*
2.	Find real cube root of 18 by Regula-Falsi method.
3.	Find the real root of the equation $x^4 - x^3 - 2x^2 - 6x - 4 = 0$
4.	Find the real root of the equation $x^2 - \log_e x - 12 = 0$
5.	Find the real root of the equation $3x = \cos x + 1$
6.	By using Newton-Raphson's method, find the root of $x^4 - x - 10 = 0$ which is near to $x = 2$, correct to three decimal places.
7.	Compute one positive root of $2x - \log_{10} x = 7$ by the Newton-Raphson method correct to four decimal places.
8.	Find the real root of the equations $\log x = \cos x$
9.	Find the real root of the equations $x^2 + 4 \sin x = 0$
10.	Using the Newton-Raphson method, obtain the formula for $\sqrt{N}$ and find $\sqrt{20}$ correct to 2 decimal places.
11.	*Find the value of sin 52° from the given table:*

θ°	45°	50°	55°	60°
sin θ	0.7071	0.7660	0.8192	0.8660

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12. *From the following table of half-yearly premiums for policies maturing at different ages, estimate the premium for policies maturing at age of 46.*

Age	*45*	*50*	*55*	*60*	*65*
Premium (in dollars)	*114.84*	*96.16*	*83.32*	*74.48*	*68.48*

13. *The following table gives the scores secured by100 students in the Numerical Analysis subject:*

Range of scores:	*30—40*	*40—50*	*50—60*	*60—70*	*70—80*
Number of students:	*25*	*35*	*22*	*11*	*7*

Use Newton's forward difference interpolation formula to find.

(i) the number of students who got scores more than 55.

(ii) the number of students who secured scores in the range between 36 and 45.

14. The following table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface.

x:	100	150	200	250	300	350	400
y:	10.63	13.03	15.04	16.81	18.42	19.9	21.27

Use Newton's forward formula to find y when x = 218 ft.

15. Given that:

x:	1	2	3	4	5	6
$y(x)$:	0	1	8	27	64	125

Find the value of $f(2.5)$.

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16. Using Newton's formula for interpolation, estimate the population for the year 1905 from the table:

Year	*Population*
1891	98,752
1901	132,285
1911	168,076
1921	195,690
1931	246,050

17. Find the number of men getting wages between $ 10 and $ 15 from the following table:

Wages (in $):	0—10	10—20	20—30	30—40
Frequency:	9	30	35	42

18. *The table given below reveals the velocity 'v' of a body during the time 't' specified. Find its acceleration at t = 1.1.*

t:	*1.0*	*1.1*	*1.2*	*1.3*	*1.4*
v:	*43.1*	*47.7*	*52.1*	*56.4*	*60.8.*

19. *Use Trapezoidal rule to evaluate* $\int_0^1 x^3\,dx$ *considering five sub-intervals.*

20. *The speed, v meters per second, of a car, t seconds after it starts, is shown in the following table:*

t	*0*	*12*	*24*	*36*	*48*	*60*	*72*	*84*	*96*	*108*	*120*
v	*0*	*3.60*	*10.08*	*18.90*	*21.60*	*18.54*	*10.26*	*5.40*	*4.50*	*5.40*	*9.00*

Using Simpson's rule, find the distance travelled by the car in 2 minutes.

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21.	*Find, from the following table, the area bounded by the curve and the x-axis from x = 7.47 to x = 7.52.* *x:* 7.47 7.48 7.49 7.50 7.51 7.52 *f(x):* 1.93 1.95 1.98 2.01 2.03 2.06.
22.	*Find* $\int_0^6 \frac{e^x}{1+x}\,dx$ *approximately using Simpson's* $\frac{3}{8}$*th rule on integration.*
23.	*A solid of revolution is formed by rotating about x-axis, the lines x = 0 and x = 1 and a curve through the points with the following coordinates.* *x:* 0 0.25 0.5 0.75 1 *y:* 1 0.9896 0.9589 0.9089 0.8415 *Estimate the volume of the solid formed using Simpson's rule.*
24.	Evaluate the integral $\int_0^{\pi/2} \sqrt{\cos\theta}\,d\theta$ by dividing the interval into 6 parts.
25.	Evaluate $\int_4^{5.2} \log_e x\,dx$ by Simpson's $\frac{3}{8}$th rule. Also write its programme in '*C*' language.
26.	Evaluate $\int_4^{5.2} \log_e x\,dx$ using Trapezoidal rule
27.	Evaluate using Trapezoidal rule $\int_{-2}^{2} \frac{t\,dt}{5+2t}$
28.	The velocities of a car running on a straight road at intervals of 2 minutes are given below: *Time (in minutes)*: 0 2 4 6 8 10 12 *Velocity (in km/hr)*: 0 22 30 27 18 7 0 Apply Simpson's rule to find the distance covered by the car.

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29.	Evaluate $\int_0^{\pi/2} \sqrt{\sin x}\, dx$ given that x: 0, π/12, π/6, π/4, π/3, 5π/12, π/2 $\sqrt{\sin x}$: 0, 0.5087, 0.7071, 0.8409, 0.9306, 0.9878, 1
30.	A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the following table. Using Simpson's $\frac{1}{3}$rd rule, find the velocity of the rocket at t = 80 seconds. $t(sec)$: 0, 10, 20, 30, 40, 50, 60, 70, 80 $f(cm/sec^2)$: 30, 31.63, 33.34, 35.47, 37.75, 40.33, 43.25, 46.69, 50.67.
31.	A curve is drawn to pass through the points given by the following table: x: 1, 1.5, 2, 2.5, 3, 3.5, 4 y: 2, 2.4, 2.7, 2.8, 3, 2.6, 2.1 Find (*i*) Center of gravity of the area. (*ii*) Volume of the solid of revolution. (*iii*) The area bounded by the curve, the x-axis and lines x = 1, x = 4.
32.	*Solve the equation* $\frac{dy}{dx} = x + y$ *with initial condition* $y(0) = 1$ *by Runge-Kutta rule, from* $x = 0$ *to* $x = 0.4$ *with* $h = 0.1$.
33.	*Given* $\frac{dy}{dx} = y - x$, $y(0) = 2$. *Find* $y(0.1)$ *and* $y(0.2)$ *correct to four decimal places.*
34.	Use the Runge-Kutta Method to approximate y when $x = 0.1$ given that $x = 0$ when $y = 1$ and $\frac{dy}{dx} = x + y$.
35.	Apply the Runge-Kutta Fourth Order Method to solve $10\frac{dy}{dx} = x^2 + y^2$; $y(0) = 1$ for $0 < x \leq 0.4$ and $h = 0.1$.

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36. Use Runge-Kutta Fourth Order Formula to find $y(1.4)$ if $y\ (1) = 2$ and $\frac{dy}{dx} = xy$. Take $h = 0.2$.

37. Solve $y' = -xy^2$ and By Runge-Kutta Fourth Order Method, find $y(0.6)$ given that $y = 1.7231$ at $x = 0.4$. Take $h = 0.2$.

38. Fit a straight line to the given data regarding x as the independent variable:

x	1	2	3	4	6	8
y	2.4	3.1	3.5	4.2	5.0	6.0

39. Find the best values of a and b so that $y = a + bx$ fits the given data:

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

40. Fit a straight line approximate to the data:

x	1	2	3	4
y	3	7	13	21

41. A simply supported beam carries a concentrated load P(lb) at its mid-point. Corresponding to various values of P, the maximum deflection Y (in) is measured. The data are given below. Find a law of the type $Y = a + bP$

P	100	120	140	160	180	200
Y	0.45	0.55	0.60	0.70	0.80	0.85

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42. The weight of a calf taken at weekly intervals is given below. Fit a straight line using the method of least squares and calculate the average rate of growth per week.

Age	1	2	3	4	5	6	7	8	9	10
Weight	52.5	58.7	65	70.2	75.4	81.1	87.2	95.5	102.2	108.4

43. If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form P = mW + c connecting P and W, using the data:

P	12	15	21	25
W	50	70	100	120

44. Using the method of least squares, fit the non-linear curve of the form $y = ae^{bx}$ to the following data:

x	0	2	4
y	5.012	10	31.62

45. Fit a curve of the form $y = ax^b$ to the data given below:

x	1	2	3	4	5
y	7.1	27.8	62.1	110	161

46. Fit an exponential curve of the form $y = ab^x$ to the following data:

x	1	2	3	4	5	6	7	8
y	1	1.2	1.8	2.5	3.6	4.7	6.6	9.1

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47. Fit a curve $y = ax^b$ to the following data:

x	1	2	3	4	5	6
y	2.98	4.26	5.21	6.1	6.8	7.5

48. A person runs the same race track for 5 consecutive days and is timed as follows:

Day (x)	1	2	3	4	5
Time (y)	15.3	15.1	15	14.5	14

49. Solve the equations by Regula-Falsi method. $2x - \log_{10} x = 7$ lying b/w 3.5 and 4

50. Solve the equations by Regula-Falsi method $x^4 + x^3 - 7x^2 - x + 5 = 0$ lying b/w 2 and 3.