

**ASSIGNMENT SET – I****Mathematics: Semester-II****M.Sc (CBCS)****Department of Mathematics****Mugberia Gangadhar Mahavidyalaya****PAPER - MTM-297****Paper: Lab 2 Language: C- Programming with Numerical Methods****Group A****Answer one question which is selected by lottery: 10×1=10**

1. Write a program in C to find the key number 25 from the list of numbers {15, 47, 78, 12, 56, 78, 25, 34, 45, 98} using Linear search technique.
2. Write a program in C to find the key number 25 from the list of sorted numbers {12, 15, 25, 34, 45, 47, 51, 56, 87, 98} using Binary search technique.
3. Write a program in C to sort the list of numbers {15, 47, 81, 12, 56, 78, 25, 34, 45, 98} using Bubble sort technique.
4. Write a program in C to sort the list of numbers {15, 47, 78, 12, 56, 88, 25, 34, 45, 98} using Insertion sort technique.
5. Write a program in C to sort the list of numbers {15, 47, 75, 12, 56, 78, 25, 34, 45, 98} using Selection sort technique.

6. Write a program in C to find the number of occurrences of a letter 'a' in a given string "Student stays focused on the task at hand".
7. Write a program in C to check whether a given string is palindrome nature or not. Test it for the strings: "deleveled", "redder", "mathematics".
8. Write a program in C to rewrite the name with surname first followed by initials of first and middle name. Test it for the names: (i) Sunil Kumar Dey (ii) Manas Kumar Mondal (iii) Soma Rani Majhi (iv) Sathi Jana
9. Write a program in C to display the string "The reverse is true as well" in a reverse order.
10. Write a program in C to search the string "quality" in the given string (Pattern Matching) "Student completes work with quality in mind".
11. Write a program in C to sort the names in alphabetic order. Test it for the names: (i) Sunil Kumar Dey (ii) Manas Kumar Mondal (iii) Soma Rani Majhi (iv) Sathi Jana (v) Rathin Samanta.
12. Write a program in C to find the letter 'd' and replace by the letter 'b' in a given string "Student is a self-motivated worker".
13. Write a program in C to find the word "daily" and replace by the word "weekly" in a given string "Student always completes daily assignments in a timely manner".
14. Write a program in C to print all combinations of letters of a word "MATH".
15. Write a program in C to convert the name into abbreviation form. Test it for the names: (i) Sunil Kumar Dey (ii) Manas Kumar Mondal (iii) Soma Rani Majhi (iv) Sathi Jana (v) Rathin Samanta.

**Group B****Answer one question which is selected by lottery:****10×1=10**

1. Write a program in C to evaluation of determinant by Gauss elimination method, using partial pivoting. Using this code compute the determinant of the following matrix

$$A = \begin{bmatrix} 2 & 0 & 4 \\ 4 & 6 & 1 \\ 5 & 1 & -2 \end{bmatrix}$$

2. Write a program in C to find matrix inverse by partial pivoting. Find the inverse of

the following matrix  $A = \begin{bmatrix} 2 & 4 & 5 \\ 1 & -1 & 2 \\ 3 & 4 & 5 \end{bmatrix}$

3. Write a program in C to find the roots of polynomial equation.
4. Write a program in C to solve the following system of equations by matrix inverse method

$$x + 2y + 3z = 10, x + 3y - 2z = 7, 2x - y + z = 5$$

5. Write a program in C to solve the equations by Gauss elimination method.

$$2x_1 + x_2 + x_3 = 4, x_1 - x_2 + 2x_3 = 2, 2x_1 + 2x_2 - x_3 = 3.$$

6. Write a program in C to find the solution of a system of equations by LU decomposition method. Hence, solve  $4x + 2y + z = 3, 2x + 5y - 2z = 4, x - 2y + 7z = 5$ .

7. Write a program in C to solve the following system of equations by Gauss-Seidal's iteration method, correct up to four decimal places.  $27x + 6y - z = 54$ ,  $6x + 15y + 2z = 72$ ,  $x + y + 54z = 110$ .
8. Write a program in C to solve the following tri-diagonal system of equation.  $x_1 + x_2 = 3$ ,  $-x_1 + 2x_2 + x_3 = 6$ ,  $3x_2 + 2x_3 = 12$ .
9. Write a program in C to obtain a quadratic polynomial approximation to  $f(x) = e^{-x}$  using Lagrange's interpolation method, taking three points  $x = 0, 1/2, 1$ .
10. The following table gives pressure of a steam plant at a given temperature. Using Newton's formula, write a program in C to compute the pressure for a temperature of  $142^\circ\text{C}$ .
- Temperature  $^\circ\text{C}$  :    140    150    160    170    180  
 Pressure,  $\text{kgf/cm}^2$ :    3.685    4.854    6.302    8.076    10.225.
11. The population of a town in decennial census were as under. Write a program in C to estimate the population for the year 1955.
- Year:                    1921    1931    1941    1951    1961  
 Population (in crore): 46    68    83    95    105.
12. Write a program in C to fit a cubic spline to the function defined by the set of points given in the following table.

x	0.10	0.15	0.20	0.25	0.30
$y = e^x$	1.1052	1.1618	1.2214	1.2840	1.3499

Use the end conditions

- (a)  $M_0 = M_N = 0$
- (b)  $p'(0.10) = y'(0.10)$  and  $p'(0.30) = y'(0.30)$  and
- (c)  $p''(0.10) = y''(0.10)$  and  $p''(0.30) = y''(0.30)$ .

Interpolate in each case for  $x = 0.12$  and state which of the end conditions gives the best fit.

13. Write a program in C to find the value of  $\int_0^1 \frac{1}{1+x^2} dx$  by Gauss's quadrature formula for  $n = 2, 4, 6$ .
14. Write a program in C to find the value of the integration of  $\int_0^1 \frac{1}{1+x^2} dx$  by Monte Carlo method for different values of  $N$ .
15. Write a program in C to Evaluate the double integral  $I = \int_0^1 \int_0^2 \frac{2xy}{\sqrt{(1+x^2)(1+y^2)}} dy dx$  using Simpson's 1/3 rule with step size  $h = k = 0.25$ .
16. Use Monte Carlo method, write a program in C to find the value of  $\int_1^5 \frac{x}{x+\cos x} dx$ , taking sample size  $N = 10$ .
17. Write a program in C to find the value of  $\int_1^2 \int_1^2 \frac{dx dy}{x^2+y^2}$  using trapezoidal rule taking  $h = k = 0.25$ .
18. Write a program in C to find the eigenvalues and eigenvectors of the symmetric matrix
 
$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$
 using Jacobi's method.
19. Write a program in C to find the largest eigenvalue in magnitude and corresponding eigenvector of the matrix  $A = \begin{bmatrix} 1 & 3 & 2 \\ -1 & 0 & 2 \\ 3 & 4 & 5 \end{bmatrix}$  using Power method.
20. Write a program in C to solve the following differential equation  $\frac{dy}{dx} = 3x^2 + y$ ,  $y(0) = 4$  for the range  $0.1 \leq x \leq 0.5$ , using Euler's method by taking  $h = 0.1$ .
21. Using modified Euler's method, write a program in C to evaluate  $y(0.1)$  correct to two significant figures from the differential equation  $\frac{dy}{dx} = y + x$ ,  $y = 1$  when  $x = 0$ , taking  $h = 0.05$ .

22. Write a program in C to solve  $\frac{dy}{dx} = xy + y^2$ , using Runge-Kutta method of fourth order, given that  $y(0) = 1$ . Take  $h = 0.2$  and find  $y$  at  $x = 0.2, 0.4, 0.6$ .
23. Consider the following system of first order differential equation  $\frac{dy}{dx} = y + 2z$ ,  $\frac{dz}{dx} = 3y + 2z$ , with  $y(0) = 6, z(0) = 4$ . Using fourth order Runge-Kutta methods, write a program in C to find the values of  $y$  and  $z$  at  $x = 0.1, 0.2$ .
24. Using Milne's predictor-corrector formula, write a program in C to find the solutions at  $x = 0.4, 0.5, 0.6$  of the differential equation  $\frac{dy}{dx} = x^3 + y^2$ ,  $y(0) = 1$ .
25. Write a program in C to solve the heat equation  $\frac{\partial u}{\partial t} = \alpha \frac{\partial^2 u}{\partial x^2}$  subject to the conditions  $u(x, 0) = 0, u(0, t) = 0$  and  $u(1, t) = 2t$ , taking  $h = 1/2, k = 1/16$ .
26. Write a program in C to solve the Poisson's equation  $u_{xx} + u_{yy} = -2x^2 + y^2$  over the region  $0 \leq x \leq 2, 0 \leq y \leq 2$  taking the boundary condition  $u = 0$  on all the boundary sides with  $h = 0.5$ .
27. Write a program in C to read a bivariate sample and calculate (i) the regression coefficient and (ii) the regression lines of  $y$  on  $x$ , and  $x$  on  $y$ .
28. Write a program in C to read a bivariate sample of size  $n$  and fit it to one of the following curves:
- The straight line  $y = a + bx$ .
  - The parabolic curve  $y = a + bx + cx^2$ .
  - The geometric curve  $y = ab^x$ .
  - The exponential curve  $y = ae^{bx}$ .
29. Write a program in C to read a multivariate sample  $(x_{1\alpha}, x_{2\alpha}, x_{3\alpha})$  of size  $n$  and find a multivariate regression line of  $x_1$  on  $x_2$  and  $x_3$ .
30. Write a program in C to find multiple and partial correlation coefficient.

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