

Name of Course	: CBCS B.Sc. (H) Mathematics
Unique Paper Code	: 32353401_OC
Name of Paper	: SEC-2 Computer Algebra Systems and Related Softwares
Semester	: IV
Duration	: 3 hours
Maximum Marks	: 38 Marks

Attempt any four questions. All questions carry equal marks.

1. (a) Write the Command to define function

$$f(x) = \begin{cases} x, & \text{if } x \leq 1 \\ x - 2, & \text{if } x > 1 \end{cases}$$

and write command to evaluate $f(x)$ at $x = 3$ and first derivative of $f(x)$ at $x = -3$. Also write command to integrate $f(x)$ over interval $[-5,5]$.

- (b) Write the command to obtain a square matrix A of order 4 with random entries between 1 and 20 and write commands to find the determinant, rank and transpose of matrix A.

2. (a) Write a command to find x, y, z, t for the following system of equations:

$$\begin{aligned} -2x - 2y + 3z + t &= 5 \\ -3x + 0y - 6z + t &= -19 \\ 6x - 8y + 6z + 5t &= 47 \\ x + 3y - 3z - t &= -9. \end{aligned}$$

- (b) Write a command to find the basis for the space spanned by the vectors

$\{v_1, v_2, v_3, v_4\}$, where

$$v_1 = (2, 1, 15, 10, 6),$$

$$v_2 = (2, -5, -3, -2, 6),$$

$$v_3 = (0, 5, 15, 10, 0),$$

$$v_4 = (2, 6, 18, 8, 6).$$

Also, write a command to find basis for the column space and to check whether the given set is linearly independent.

3. Write a command to plot the function $f(x) = x^2 \frac{1}{\sin x}$ over the domain $-20 \leq x \leq 20$ with a two dimensional slider with the label "Move the axes" by assuming minimum and maximum value for the axes as -20 and 20, respectively. Place the control to the right.

4. Explain the following in software-R

- (i) Explain stem and leaf plot with example.
- (ii) Write difference between `as.data.frame()` and `data.frame()` commands.
- (iii) Write command to create a 3x3 square matrix "A" and add row and column names to this matrix "A" after creating.
- (iv) What is difference between matrix and data fame.
- (v) Write difference between `order()` and `rank()` commands.
- (vi) What is difference between Cleveland dot charts and bar charts.
- (viii) Write difference between vector and list.

5. Write possible R commands for the following questions:

	C1	C2	C3	C4	C5
R1	38	31	7	15	25
R2	56	89	56	NA	11
R3	17	95	23	89	75
R4	77	55	11	45	99
R5	65	NA	26	10	28
R6	91	8	70	77	65

- (i) Change row name "R2" to "Row2" of this matrix.
 - (ii) Extract rows and columns; find the mean and standard deviation of each row.
 - (iii) Write code to draw histogram of "C2".
 - (iv) Convert this matrix into data frame.
 - (v) Find mean of the vector "Row 2" of the converted data frame.
6. (a) Write a R program to create a data frames which contain details of 5 employees and display the details: Name, Gender, Age, Designation and SSN No.
- (b) Write a R program to create a simple bar plot of ten subjects marks.
- (c) Write a R program to create a vector which contains 20 random integer values between -100 and +100