(c) Find matrix multiplication of M and·N.

(d) $\sum_{i=1}^{20} i^3$

(e) $3^6 \bmod 11$

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[This question paper contains 6 printed pages.]

**Your Roll No...............**

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. **All** questions are compulsory.

1. Fill in the blanks :        (1×10)

   (i) Mathematica assigns line numbers to the input as .............. and to the output as ...........

   (ii) To multiply two numbers in Mathematica, we use .............

(iii)   Maxima use ........... for matrix multiplication.

(iv)    ...;..................... is used to clear variables in Maxima.

(v)     In Maple, the command ......... evaluates an expression.

(vi)    The built-in constant e is represented by ........... in Maple.

(vii)   The command ............ returns the determinant of a matrix in MATLAB/Octave.

(viii)  The adjoint of a matrix A is given by the command ............. in MATLAB/Octave.

(ix)    The command for $\log_4 30$ in R is .................

(x)     In R, the function ........... produces histograms.

2.   Answer any eight parts from the following :          $(2\frac{1}{2}\times 8)$

(i)     Write the command in R to put the list of values 7,5,9,2,1,8,4,2,4 into a variable a and find mean and median.

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(ii)    Write a program in MATLAB/Octave to solve the system of equation

$$x + 2y - z + t = 23$$

$$-6x + y + 3z - 3t = -15$$

$$-3x + 6y + 4z - 2t = 12$$

$$4x + 7y - 3z + t = 20$$

(iii)   Write a program in Mathematica to plot the function

$f(x) = x^2 + e^x$, $g(x) = x \sin x$ and $h(x) = \dfrac{x^2}{1+x^3}$ for $0 \le x \le 3$. Use the commands for plot Legend, color and thickness.

(iv)    Explain thru-do loop in Maxima. Set $c = -0.5 + 0.5i$ and $z = 0$, Then write a program in Maxima to iterate $f(z) = z^3 + c$ twenty times.

(v)     Write the command in Maple for the following :

(a) Let $M = \begin{pmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 0 & 3 & 4 \end{pmatrix}$ and $N = \begin{pmatrix} -1 & 0 & 4 \\ 3 & 2 & 1 \\ 6 & -3 & 5 \end{pmatrix}$

(b) Find $M + N$

(vii) Define and integrate a function $g(x) = \cos x + 2x^2$ in Maxima.

(viii) Write a command to find prime factorization of the number 60466176 in Maple.

(ix) Write a program to plot two lines $y = 4x + 1$ and $y = -x + 4$ for $0 \le x \le 2$ in Maple.

(x) What is the use of the function block() in Maxima.

3. Answer any **four** questions from the following :      (5×4)

   (i) Write a program in R for the following :

      (a) Consider the table of data

| x | 2 | 3 | 13 | 4 | 10 | 12 | 12 | 16 |
|---|---|---|----|---|----|----|----|----|
| y | 4 | 6 | 18 | 16 | 19 | 16 | 20 | 5 |

      (b) Draw a scatter plot of data points (x,y).

      (c) Find correlation between x and y.

      (d) Compute a line of best fit for the data.

      (e) Add the line of best fit to the scatter plot.

(ii) Write the command in R for the following :

   (a) Take scores of 10 students for each exam1 and exam2 separately.

   (b) Find correlation between exam1 and exam2.

(iii) Write the output for the following MATLAB/Octave command

$$A=\text{ones (4)-eye (4)}$$

(iv) Write a program in MATLAB/Octave to plot the graph of function $y = \sin x$ for the range $0 \le x \le 2\pi$ with step size 0.02.

(v) Write two differences between Mathematica and Maxima.

(vi) Write the commands for Mathematica.

   (a) 10 mod 3     (b) sin 4

   (c) $\log_{10} 5$     (d) $\cos^{-1}\left(\dfrac{1}{2}\right)$

   (e) $\sum_{j=1}^{10} j^2$