Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF INFORMATION SCIENCE
END TERM EXAMINATION - JAN 2023

Semester : Semester III - 2022
Course Code : MAT2023
Course Name : Sem I - MAT2023 - Matrix Computations for Data Science
Program : B.Sc. Data Science

Date : 13-JAN-2023
Time : 9.30AM - 12.30PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE FOLLOWING QUESTIONS **10 X 2 = 20M**

1. Whether the following statement is true. A homogeneous linear system has at least one solution.
(CO1) [Knowledge]

2. Whether $AB = I \Rightarrow BA = I$ for square matrices.
(CO1) [Knowledge]

3. Whether $A + A^T$ is symmetric for any matrix A.
(CO2) [Knowledge]

4. Let $A = \begin{bmatrix} 2 & 3 & 1 \\ 4 & 5 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ 1 & 1 \end{bmatrix}$. Define $C = AB$.Then find c_{12}
(CO2) [Knowledge]

5. Define null space of a matrix.
(CO2) [Knowledge]

6. Whether for every invertible matrix $A,\ Av = \lambda v \Rightarrow A^{-1}v = \lambda^{-1}v.$,
(CO3) [Knowledge]

7. Is every invertible matrix is diagonalizable?
(CO3) [Knowledge]

8. How you define the length of a vector?
(CO4) [Knowledge]

9. Find all values of a such that $u = \begin{bmatrix} 1 \\ -13 \\ a \end{bmatrix}$ and $v = \begin{bmatrix} -3 \\ 1 \\ a \end{bmatrix}$ are orthogonal.

(CO4) [Knowledge]

10. Define orthogonality of Vectors.

(CO3) [Knowledge]

PART B

ANSWER ALL THE FOLLOWING QUESTIONS **5 X 10 = 50M**

11. Whether the matrix $A = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{bmatrix}$ is in reduced row echelon form. Determine its reduced row echelon form.

(CO1) [Comprehension]

12. Solve the linear system $Ax = b$ by giving LU-factorization where $A = \begin{bmatrix} 2 & 8 & 0 \\ 2 & 2 & -3 \\ 1 & 2 & 7 \end{bmatrix}$, $b = \begin{bmatrix} 18 \\ 1 \\ 12 \end{bmatrix}$

(CO1) [Comprehension]

13. Let $A = \begin{bmatrix} 4 & 3 & 2 \\ 3 & -2 & 5 \\ 2 & 4 & 6 \end{bmatrix}$. Compute the determinant using row reduction.

(CO2) [Comprehension]

14. If possible, find a matrix P that diagonalizes $A \begin{bmatrix} 1 & 0 & 0 \\ 1 & 2 & 0 \\ -3 & 5 & 2 \end{bmatrix}$.

(CO3) [Comprehension]

15. Use the Gram-Schmidt Process to find an orthogonal basis for the column spaces of the matrix $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$.

(CO4) [Comprehension]

PART C

ANSWER ALL THE FOLLOWING QUESTIONS **2 X 15 = 30M**

16. Let $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 5 & -2 \\ 1 & 1 & 2 \end{bmatrix}$.

(a) Find all eigenvalues of A.
(b) Is A diagonalizable? if Yes, find P such that $D = P^{-1}AP$ is diagonal.

(CO3) [Application]

17. For the system $Ax = b$, where $A = \begin{bmatrix} 1 & 2 & -1 \\ -3 & -5 & 2 \\ 2 & 3 & -1 \end{bmatrix}$ and $b = \begin{bmatrix} -1 \\ -3 \\ 1 \end{bmatrix}$, obtain the solution of least norm.

(CO4) [Application]

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