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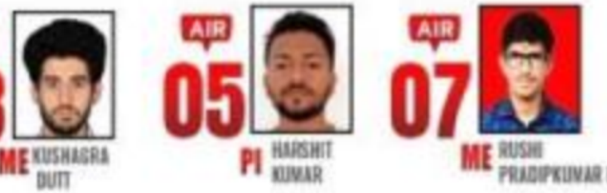

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GATE 2024-25	ELECTRICAL MACHINE	7:30 PM	SANTAN SIR
GATE 2024-25	COMMUNICATION	9:00 PM	RENU SIR

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GATE 2024-25	ENVIRONMENT	8:00 PM	PRATIK SIR
GATE 2024-25	SOM	9:00 PM	MUKESH SIR

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ALL PSUs	THERMODYNAMICS	3:00 PM	KANISTH SIR
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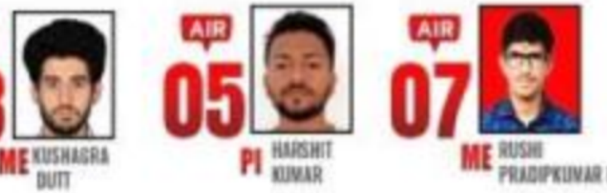

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Q:153 If matrix A is m × n and B is n × p, the number of multiplication operations and addition operations needed to calculate the matrix AB, respectively, are :

(a) mn^2p, mpn

(b) mpn, (n – 1)

(c) mpn, mp(n – 1)

(d) mn^2p, (m + p)n

$A_{m\times n}$ $B_{n\times p}$

total number of multiplication = $n\times(m\times p)$

total number of additions = $(n-1)(m\times p)$

$A_{3\times 2}$ $B_{2\times 2}$

$AB = \begin{bmatrix} 0+0 & - \\ - & - \\ - & - \end{bmatrix}_{3\times 2}$

Q:154

Let A be an $m \times n$ matrix and B an $n \times m$ matrix. It is given that determinant $(I_m + AB)$ = determinant $(I_n + BA)$, where I_k is the $k \times k$ identity matrix. Using the above property, the determinant of the matrix given below is

$$\begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix}_{4\times4}$$

(a) 2

(b) 5

(c) 8

(d) 16

$A_{m\times n}$ $B_{n\times m}$

method: 1

$R_3 \leftarrow R_3 - R_2$, $R_4 \leftarrow R_4 - R_2$, $R_1 \leftarrow R_1 - 2R_2$

$$\begin{bmatrix} 0 & -3 & -1 & -1 \\ 1 & 2 & 1 & 1 \\ 0 & -1 & 1 & 0 \\ 0 & -1 & 0 & 1 \end{bmatrix}$$

$\Rightarrow -1(-1) + 1(+3+1)$

$= 1 + 4 = 5$

$A_{m\times n}\, B_{n\times m} \longrightarrow (AB)_{m\times m}$

$B_{n\times m}\, A_{m\times n} \longrightarrow (BA)_{n\times n}$

$$\left|(I_m + AB)\right| = \left|(I_n + BA)\right|$$

let $C = \begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

$\Rightarrow C = I_4 + (AB)_{4\times 4}$

$AB = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

$A_{4\times}\ \ B_{-\times 4}$

if

$A_{4\times 1}$ & $B_{1\times 4} \rightarrow BA_{1\times 1}$

$A_{4\times 2}$ & $B_{2\times 4} \rightarrow BA_{2\times 2}$

$A_{4\times 3}$ & $B_{3\times 4} \rightarrow BA_{3\times 3}$

$A_{4\times 4}$ & $B_{4\times 4} \rightarrow BA_{4\times 4}$

$$A = \begin{bmatrix} a \\ a \\ a \\ a \end{bmatrix} \quad B = \begin{bmatrix} \frac{1}{a} & \frac{1}{a} & \frac{1}{a} & \frac{1}{a} \end{bmatrix}$$

So let $A = \begin{bmatrix} -2 \\ -2 \\ -2 \\ -2 \end{bmatrix}$ $B = \begin{bmatrix} -\frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \end{bmatrix}$

$$AB = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$\Rightarrow BA = \begin{bmatrix} -\frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \end{bmatrix} \begin{bmatrix} -2 \\ -2 \\ -2 \\ -2 \end{bmatrix}$$

$BA = [1+1+1+1]$

$BA = 4$

from R.H.S. $= |(I_n + BA)| = |1+4| = 5$

Q:155

The rank of the matrix $\begin{bmatrix} 1 & -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & -1 & 0 \\ 0 & 1 & -1 & 0 & 0 \\ -1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & -1 \end{bmatrix}_{5\times5}$ is

Rank = 5

Q:156

If $A = \begin{bmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 6 \end{bmatrix}$, then the rank of matrix A is

(a) 2

(b) 5

(c) 4

(d) 3

$$\begin{bmatrix} -1 & 2 & 3 & -2 \\ 0 & -1 & 7 & -2 \\ 0 & -2 & 14 & -4 \\ 0 & -2 & 14 & -4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 & -2 \\ 0 & -1 & 7 & -2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Q:157

If the system

$$2x - y + 3z = 2$$
$$x + y + 2z = 2$$
$$5x - y + az = b$$

has infinitely many solutions, then the values of a and b, respectively, are

(a) –8 and 6 (b) 8 and 6

(c) –8 and –6 (d) 8 and –6

ESE-2018

$$\left[\begin{array}{ccc:c} 2 & -1 & 3 & 2 \\ 1 & 1 & 2 & 2 \\ 5 & -1 & a & b \end{array}\right]$$

$$\left[\begin{array}{ccc:c} 0 & -3 & -1 & -2 \\ 1 & 1 & 2 & 2 \\ 0 & -6 & a-10 & b-10 \end{array}\right]$$

$$\left[\begin{array}{ccc:c} 0 & -3 & -1 & -2 \\ 1 & 1 & 2 & 2 \\ 0 & 0 & a-8 & b-6 \end{array}\right]$$

$\rho(A) = \rho(AB) <$ no. of variable

$a-8=0$ $\quad b-6=0$

$a=8$ $\quad b=6$

Q:158 The solution of the system of equations $x + y + z = 4$, $x - y + z = 0$, $2x + y + z = 5$ is

(a) $x = 2, y = 2, z = 2$

(b) $x = 1, y = 4, z = 1$

(c) $x = 2, y = 4, z = 3$

(d) $x = 1, y = 2, z = 1$

[ESE-2017]

Q:159

Consider the following system of linear equations.

$x_1 + 2x_2 = b_1$; $2x_1 + 4x_2 = b_2$; $3x_1 + 7x_2 = b_3$; $3x_1 + 9x_2 = b_4$

Which one of the following conditions ensures that a solution exists for the above system?

(a) $b_2 = 2b_1$ and $6b_1 - 3b_3 + b_4 = 0$

(b) $b_2 = 2b_1$ and $3b_1 - 6b_3 + b_4 = 0$

(c) $b_3 = 2b_1$ and $3b_1 - 6b_3 + b_4 = 0$

(d) $b_3 = 2b_1$ and $6b_1 - 3b_3 + b_4 = 0$

$\rho(A) = \rho(AB) = 1$

$b_2 = 2b_1$
$b_3 = 3b_1$
$b_4 = 3b_3 - 6b_1$

$$\begin{bmatrix} 1 & 2 & b_1 \\ 2 & 4 & b_2 \\ 3 & 7 & b_3 \\ 3 & 9 & b_4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & b_1 \\ 0 & 0 & b_2 - 2b_1 \\ 0 & 1 & b_3 - 3b_1 \\ 0 & 3 & b_4 - 3b_1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & b_1 \\ 0 & 0 & b_2 - 2b_1 \\ 0 & 0 & b_3 - 3b_1 \\ 0 & 0 & b_4 - 3b_3 + 6b_1 \end{bmatrix}$$

Q:160

If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$, then which one of the following is correct?

(a) $A^3 - 3A^2 - 4A + 11I = 0$

(b) $A^3 - 4A^2 - 3A + 11I = 0$ ✓

(c) $A^3 + 4A^2 - 3A + 11I = 0$

(d) $A^3 - 3A^2 + 4A + 11I = 0$

with C-H. theorem

$A^3 - 4A^2 - 3A + 11I = 0$

$|A - \lambda I| = 0$

$$\begin{vmatrix} 1-\lambda & 3 & 2 \\ 2 & -\lambda & -1 \\ 1 & 2 & 3-\lambda \end{vmatrix} = 0$$

$(1-\lambda)(\lambda^2 - 3\lambda + 2) - 3(6 - 2\lambda + 1) + 2(4 + \lambda) = 0$

$\Rightarrow -\lambda^3 + 4\lambda^2 - 5\lambda + 2 + 6\lambda - 21 + 8 + 2\lambda = 0$

$-\lambda^3 + 4\lambda^2 + 3\lambda - 11 = 0 \Rightarrow \lambda^3 - 4\lambda^2 - 3\lambda + 11 = 0$

Q:161

The highest Eigen value of 2×2 matrix $\begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ is

(a) –1
(b) –5
(c) 5
(d) 1

[ESE-2021]

Q:162

For the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ the expression

$A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$

is equivalent to

(a) $A^2 + A + 5I$

(b) $A + 5I$

(c) $A^2 + 5I$

(d) $A^2 + 2A + 6I$

[ESE-2020]

Q:163

The lowest Eigen value of the 2×2 matrix $\begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$ is

(a) 1
(b) 2
(c) 3
(d) 5

[ESE-2019]

Q:164 Let I be a 100 dimensional identity matrix and E be the set of its distinct (no value appears more than once in E) real eigenvalues. The number of elements in E is _____.

[GATE-2020 ME SET-II]

Q:165

Let $A = \begin{bmatrix} 1 & 0 & -1 \\ -1 & 2 & 0 \\ 0 & 0 & -2 \end{bmatrix}$ and $B = A^3 - A^2 - 4A + 5I$, where I is the 3×3 identity matrix. The determinant of B is _____(up to 1 decimal place)

THANKS FOR

Watching

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