Rajiv Gandhi University of Knowledge Technologies

Weekly Test 6 – Matrix Algebra

Date: 29-09-2012 **Time:** 30 Min

Course: E2Sem1_ECE/ E2Sem1_ABC/E3Sem1_ABC **Max Marks:** 10

Answer Any TEN of the Following $\mathbf{10 \times 1 = 10M}$

1. If $\boldsymbol{A}$ is an $n \times n$ nilpotent matrix, then the $\mathrm{tr}(\boldsymbol{A})$ is

   A. 0
   B. n
   C. $n - 1$
   D. $2n$

2. If $\boldsymbol{A}$ is an $n \times n$ projection matrix, then the trace of $\boldsymbol{A}$ is equal to

   A. $\mathrm{tr}(\boldsymbol{A}^n)$
   B. $\mathrm{rank}(\boldsymbol{A})$
   C. n
   D. Zero

3. The characteristic equation of $\boldsymbol{A}$ is $\lambda^3(\lambda + 1)^4(\lambda - 3)^2 = 0$, then the trace of $\boldsymbol{A}$ is

   A. 0
   B. 2
   C. 5
   D. 9

4. If $\boldsymbol{A} = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and $\boldsymbol{P}$ is a modal matrix of $\boldsymbol{A}$, then the $\mathrm{tr}(\boldsymbol{P}^{-1}\boldsymbol{A}\boldsymbol{P})$ is

   A. -1
   B. 1
   C. 7
   D. 11

5. If $\boldsymbol{A}, \boldsymbol{B}$ and $\boldsymbol{C}$ are $n \times n$ matrices, then which of the following is not true?

   A. $\mathrm{tr}(\boldsymbol{A}\boldsymbol{B}) = \mathrm{tr}(\boldsymbol{B}\boldsymbol{A})$
   B. $\mathrm{tr}(\boldsymbol{C}^{*}) = \overline{tr(\boldsymbol{C})}$
   C. $\mathrm{tr}(\boldsymbol{B}^{T}\boldsymbol{B}) = 0 \Leftrightarrow \boldsymbol{B} = 0$
   D. $\mathrm{tr}(\boldsymbol{A}\boldsymbol{B}\boldsymbol{C}) = \mathrm{tr}(\boldsymbol{B}\boldsymbol{A}\boldsymbol{C})$

6. If $\boldsymbol{A} = \left(a_{ij}\right)_{n\times n}$ and $\boldsymbol{B} = \left(b_{ij}\right)_{n\times n}$ where $\boldsymbol{A}$ and $\boldsymbol{B}$ are symmetric and skew-symmetric matrices respectively, then $\mathrm{tr}(\boldsymbol{A}\boldsymbol{B})$ is

   A. $\mathrm{tr}(\boldsymbol{A} + \boldsymbol{B})$
   B. $\sum_{i=1}^{n} a_{ii}$
   C. $\mathrm{tr}\boldsymbol{A}.\mathrm{tr}\boldsymbol{B}$
   D. Cannot be predicted

7. Every matrix has

   A. Unique generalized inverse
   B. Two generalized inverses
   C. At least one generalized inverse
   D. At most two generalized inverses

8. For any $m \times n$ matrix $\boldsymbol{A}$ and $n \times p$ matrix $\boldsymbol{B}$, we have

   A. $\mathcal{C}(\boldsymbol{AB}) = \mathcal{C}(\boldsymbol{A})$
   B. $\mathcal{C}(\boldsymbol{AB}) \supset \mathcal{C}(\boldsymbol{A})$
   C. $\mathcal{C}(\boldsymbol{AB}) \subset \mathcal{C}(\boldsymbol{A})$
   D. $\mathcal{R}(\boldsymbol{AB}) \supset \mathcal{R}(\boldsymbol{A})$

9. Let $\boldsymbol{A}$ be an $m \times n$ matrix and for any $m \times p$ matrix $\boldsymbol{B}$ such that $\mathcal{C}(\boldsymbol{B}) \subset \mathcal{C}(\boldsymbol{A})$. Then

   A. $(\boldsymbol{I} - \boldsymbol{AA}^{-})\boldsymbol{B} = 0$
   B. $\boldsymbol{BAA}^{-} = \boldsymbol{B}$
   C. $\boldsymbol{AA}^{-} = \boldsymbol{B}$
   D. $\boldsymbol{AA}^{-} - \boldsymbol{I} = \boldsymbol{A}$

10. Which of the following statements is true for any matrix $\boldsymbol{A}$?

    1. $\text{rank}(\boldsymbol{A}^{-}\boldsymbol{A}) = \text{rank}(\boldsymbol{A})$
    2. $\text{rank}(\boldsymbol{A}^{-}) \leq \text{rank}(\boldsymbol{A})$

    A. Both 1 and 2 are true
    B. 1 is true but not 2
    C. 2 is true but not 1
    D. Neither 1 nor 2 is true

11. Right inverse of $\begin{bmatrix} 1 & -1 & 1 & 0 \\ 1 & 0 & -1 & 1 \\ 0 & -1 & 1 & 0 \end{bmatrix}$ is

A. $\frac{1}{3}\begin{bmatrix} 7 & 4 & -3 \\ 1 & -5 & -3 \\ -3 & 3 & 0 \\ 2 & 2 & 3 \end{bmatrix}$

B. $\frac{1}{3}\begin{bmatrix} 3 & 4 & -3 \\ 1 & -5 & -3 \\ -3 & 3 & 0 \\ 2 & 0 & 3 \end{bmatrix}$

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

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

12. Generalized inverse of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ is

A. $\begin{bmatrix} \frac{1}{9} & \frac{1}{9} & \frac{1}{9} \\ \frac{1}{9} & \frac{1}{9} & \frac{1}{9} \\ \frac{1}{9} & \frac{1}{9} & \frac{1}{9} \end{bmatrix}$

B. $\begin{bmatrix} \frac{1}{6} & \frac{1}{6} & \frac{1}{6} \\ \frac{1}{6} & \frac{1}{6} & \frac{1}{6} \\ \frac{1}{6} & \frac{1}{6} & \frac{1}{6} \end{bmatrix}$

C. $\begin{bmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{bmatrix}$

D. Not exist

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KEY

1. A
2. B
3. B
4. C
5. D
6. C
7. C
8. C
9. A
10. B
11. D
12. A