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NPTEL

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Courses » Applied Optimization for Wireless, Machine Learning, Big-Data

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Unit 5 - Week 3 : Convex/ Concave Functions, Examples, Conditions for Convexity. Application: Beamforming in Wireless Systems, Multi-User Wireless, Cognitive Radio Systems

Assignment-3

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment.

Due on 2018-09-05, 23:59 IST.

1) Consider an $m \times n$ complex matrix $\mathbf{A}$. The quantity $\mathrm{Tr}(\mathbf{A}\mathbf{A}^H)$ is *1 point*

- $\sum_{i=1}^{m} a_{ii}^2$
- $\sum_{i=1}^{m} |a_{ii}|^2$
- $\sum_{j=1}^{n}\sum_{i=1}^{m} |a_{ij}|^2$
- $\sum_{j=1}^{n}\sum_{i=1}^{m} a_{ij}^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sum_{j=1}^{n}\sum_{i=1}^{m} |a_{ij}|^2$

2) An orthonormal basis for the null space of $\mathbf{A} = [1 \quad 1 \quad 1]^T$ is *1 point*

- $\begin{bmatrix}1 \\ \end{bmatrix} \begin{bmatrix}0 \\ \end{bmatrix} \begin{bmatrix}0 \\ \end{bmatrix}$

ce De

$$\frac{1}{\sqrt{3}}\begin{bmatrix}1\\-1\\-1\end{bmatrix}, \frac{1}{\sqrt{3}}\begin{bmatrix}1\\1\\-1\end{bmatrix}$$

$$\begin{bmatrix}0\\0\\0\end{bmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{1}{\sqrt{6}}\begin{bmatrix}1\\1\\-2\end{bmatrix}, \frac{1}{\sqrt{2}}\begin{bmatrix}1\\-1\\0\end{bmatrix}$$

3) The eigenvalues of a Hermitian symmetric matrix are *1 point*

- Non-negative
- Positive
- Real but not necessarily non-negative
- Complex

No, the answer is incorrect.
Score: 0

Accepted Answers:
Real but not necessarily non-negative

4) The eigenvalues of a Positive Semi-Definite matrix are *1 point*

- Non-negative
- Positive
- Real but not necessarily non-negative
- Complex

No, the answer is incorrect.
Score: 0

Accepted Answers:
Non-negative

5) The eigenvalues of the matrix $\begin{bmatrix}1 & 0 & 0\\0 & 1 & 0\\0 & 0 & -1\end{bmatrix}$ are *1 point*

- $-1, -1, 1$
- $1, 1, -1$
- $1, 0, -1$
- $1, 0, 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$1, 1, -1$

6) The complete set of eigenvectors of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ is

1 point

- $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$
- $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ -1 \end{bmatrix}$
- $\begin{bmatrix} x \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ y \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ z \end{bmatrix}$, where x, y, z are arbitrary real numbers
- $\begin{bmatrix} x \\ y \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ z \end{bmatrix}$, where x, y, z are arbitrary real numbers

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\begin{bmatrix} x \\ y \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ z \end{bmatrix}$, *where x, y, z are arbitrary real numbers*

7) The inverse of matrix $(\mathbf{A} + \mathbf{BCD})^{-1}$ is

1 point

- $\mathbf{A}^{-1} - \mathbf{B}^{-1}\mathbf{C}^{-1}\mathbf{D}^{-1}$
- $\mathbf{A}^{-1} - \mathbf{A}^{-1}\mathbf{B}(\mathbf{C}^{-1} + \mathbf{DA}^{-1}\mathbf{B})^{-1}\mathbf{DA}^{-1}$
- $\mathbf{A}^{-1} - \mathbf{DA}^{-1}(\mathbf{C}^{-1} + \mathbf{DA}^{-1}\mathbf{B})\mathbf{A}^{-1}\mathbf{B}$
- $\mathbf{A}^{-1} - \mathbf{B}(\mathbf{A}^{-1} + \mathbf{BC}^{-1}\mathbf{D})^{-1}\mathbf{D}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{A}^{-1} - \mathbf{A}^{-1}\mathbf{B}(\mathbf{C}^{-1} + \mathbf{DA}^{-1}\mathbf{B})^{-1}\mathbf{DA}^{-1}$

8) The inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ is

1 point

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

$$\begin{bmatrix} \frac{3}{4} & -\frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{4} & \frac{3}{4} & -\frac{1}{4} \\ -\frac{1}{4} & -\frac{1}{4} & \frac{3}{4} \end{bmatrix}$$

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

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

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\begin{bmatrix} \frac{3}{4} & -\frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{4} & \frac{3}{4} & -\frac{1}{4} \\ -\frac{1}{4} & -\frac{1}{4} & \frac{3}{4} \end{bmatrix}$$

9) Consider an $m \times n$ real matrix $\mathbf{A}$. Then, rank $(\mathbf{A}\mathbf{A}^T)$ *1 point*

Equals rank $(\mathbf{A})$

Can be greater than rank $(\mathbf{A})$

Can be lower than rank $(\mathbf{A})$

Is not related to rank $(\mathbf{A})$

No, the answer is incorrect.
Score: 0

Accepted Answers:
Equals rank $(\mathbf{A})$

10) Which of the following denotes a convex combination of two points $\bar{\mathbf{x}}_1, \bar{\mathbf{x}}_2$, *1 point*

$\frac{1}{2}\bar{\mathbf{x}}_1 - \frac{1}{2}\bar{\mathbf{x}}_2$

$\frac{3}{4}\bar{\mathbf{x}}_1 + \frac{1}{4}\bar{\mathbf{x}}_2$

$\frac{1}{4}\bar{\mathbf{x}}_1 + \frac{1}{4}\bar{\mathbf{x}}_2$

$\frac{5}{4}\bar{\mathbf{x}}_1 - \frac{1}{4}\bar{\mathbf{x}}_2$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\frac{3}{4}\bar{\mathbf{x}}_1 + \frac{1}{4}\bar{\mathbf{x}}_2$