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NPTEL

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

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Unit 2 - Week 1 : Introduction to properties of Vectors, Norms, Positive Semi-Definite matrices and Gaussian Random Vectors

Assignment-1

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-08-15, 23:59 IST.

1) The l_2 norm of a possibly complex vector $\bar{\mathbf{x}}$ is *1 point*

- $|x_1|^2 + |x_2|^2 + \cdots + |x_n|^2$
- $\sqrt{|x_1|^2 + |x_2|^2 + \cdots + |x_n|^2}$
- $|x_1| + |x_2| + \cdots + |x_n|$
- $\sqrt{x_1^2 + x_2^2 + \cdots + x_n^2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sqrt{|x_1|^2 + |x_2|^2 + \cdots + |x_n|^2}$

2) The unit-norm vector along $[1 \ \ 2 \ldots \ \ n]^T$ is *1 point*

- $\frac{1}{\sqrt{n}}\begin{bmatrix}1\\1\\\vdots\\1\end{bmatrix}$

ce De

$$\frac{1}{\sqrt{\frac{n(n+1)(2n+1)}{6}}}\begin{bmatrix}1\\2\\\vdots\\n\end{bmatrix}$$

$$\frac{1}{\sqrt{\frac{n(n+1)}{2}}}\begin{bmatrix}1\\2\\\vdots\\n\end{bmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{1}{\sqrt{\frac{n(n+1)(2n+1)}{6}}}\begin{bmatrix}1\\2\\\vdots\\n\end{bmatrix}$$

3) The vectors $\bar{\mathbf{w}}_1, \bar{\mathbf{w}}_2, \ldots, \bar{\mathbf{w}}_n$ are linearly dependent if *1 point*

There exist $c_1, c_2, \ldots, c_n$, none of which is zero, such that $c_1\bar{\mathbf{w}}_1 + c_2\bar{\mathbf{w}}_2 + \cdots + c_n\bar{\mathbf{w}}_n = 0$

There exist $c_1, c_2, \ldots, c_n$, not all zero, such that $c_1\bar{\mathbf{w}}_1 + c_2\bar{\mathbf{w}}_2 + \cdots + c_n\bar{\mathbf{w}}_n \neq 0$

There exist $c_1, c_2, \ldots, c_n$,none of which is zero, such that $c_1\bar{\mathbf{w}}_1 + c_2\bar{\mathbf{w}}_2 + \cdots + c_n\bar{\mathbf{w}}_n \neq 0$

There exist $c_1, c_2, \ldots, c_n$, not all zero, such that $c_1\bar{\mathbf{w}}_1 + c_2\bar{\mathbf{w}}_2 + \cdots + c_n\bar{\mathbf{w}}_n = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
There exist $c_1, c_2, \ldots, c_n$, not all zero, such that $c_1\bar{\mathbf{w}}_1 + c_2\bar{\mathbf{w}}_2 + \cdots + c_n\bar{\mathbf{w}}_n = 0$

1.4) The eigenvector $\bar{\mathbf{x}}$ of matrix $\mathbf{A}$ corresponding to eigenvalue λ satisfies *1 point*

$\mathbf{A}\bar{\mathbf{x}} = \lambda\bar{\mathbf{x}}$

$|\mathbf{A}\bar{\mathbf{x}} - \lambda\bar{\mathbf{x}}| = 0$

$\mathbf{A}\bar{\mathbf{x}} = \lambda$

$\mathbf{A} = \lambda\bar{\mathbf{x}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{A}\bar{\mathbf{x}} = \lambda\bar{\mathbf{x}}$

5) *1 point*

The eigenvalues of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ are

- 1,2,3
- 1,1,1
- 3,0,0
- 1,0,0

No, the answer is incorrect.
Score: 0

Accepted Answers:
3,0,0

6) The matrix $\begin{bmatrix} 3 & 2 \\ 2 & x \end{bmatrix}$ is positive semi-definite only for ***1 point***

- $x \geq 2$
- $x \leq 3$
- $x \geq \frac{4}{3}$
- $x \leq 4$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x \geq \frac{4}{3}$

7) Which of the following properties are true for a real positive semi-definite matrix **A** ***1 point***

- $\bar{\mathbf{x}}^T \mathbf{A} \bar{\mathbf{x}} \geq 0$ for all $\bar{\mathbf{x}}$
- All eigenvalues of $\bar{\mathbf{x}}$ are non-negative
- **A** can be represented as the covariance matrix of a random vector
- All of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
All of the above

8) Given a Gaussian random variable X with mean μ and variance σ^2, the quantity $\frac{X-\mu}{\sigma}$ is ***1 point***

- an Exponential RV
- a Standard Normal RV

a Laplacian RV

a Gaussian RV with mean μ and variance σ

No, the answer is incorrect.
Score: 0

Accepted Answers:
a Standard Normal RV

9) The multi-variate Gaussian distribution of random vector $\bar{\mathbf{x}}$ with mean $\bar{\mu}$ and covariance matrix **R** is *1 point*

$\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\mu})^T\mathbf{R}(\bar{\mathbf{x}}-\bar{\mu})}$

$\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\mu})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\mu})}$

$\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}|\bar{\mathbf{x}}-\bar{\mu}|^2}$

$\frac{1}{\sqrt{(2\pi)^n}} e^{-\frac{1}{2}|\bar{\mathbf{x}}-\mathbf{R}\bar{\mu}|^2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}} e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\mu})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\mu})}$

10) Consider the complex Gaussian random vector $\bar{X} = [X_1 \;\; X_2 \;\; \ldots \;\; X_n]^T$ with i.i.d. elements X_i.Let the real and imaginary parts of each X_i be i.i.d. with mean $\frac{\mu}{2}$ and variance $\frac{\sigma^2}{2}$ each. The quantity $E\{\bar{X}\bar{X}^T\}$ is *1 point*

0

$\sigma^2\mathbf{I}$

$\sigma^2\mathbf{I} + \mu^2\bar{\mathbf{1}}\bar{\mathbf{1}}^T$

$j\frac{\mu^2}{2}\bar{\mathbf{1}}\bar{\mathbf{1}}^T$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$j\frac{\mu^2}{2}\bar{\mathbf{1}}\bar{\mathbf{1}}^T$

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