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

Announcements Course Ask a Question Progress Mentor FAQ

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

Course outline

How to access the portal

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

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Week 2: Introduction to Convex Optimization – Convex sets, Hyperplanes/ Half-spaces etc. Application: Power constraints in Wireless Systems

Week 3 : Convex/ Concave Functions, Examples, Conditions for

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 $\text{Tr}(\mathbf{A}\mathbf{A}^H)$ 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 $\mathbf{A} = [1 \ 1 \ 1]^T$ is **1 point**

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

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Cognitive Radio Systems

- Lec 13- Norm Ball and its Practical Applications
- Lec 14- Ellipsoid and its Practical Applications
- Lec 15- Norm Cone, Polyhedron and its Applications
- Lec 16- Applications: Cooperative Cellular Transmission
- Lec 17- Positive Semi Definite Cone And Positive Semi Definite (PSD) Matrices
- Lec 18- Introduction to Affine functions and examples
- Quiz : Assignment-3
- WEEK-3 FEEDBACK
- Assignment-3 Solution

Week 4 : Convex Optimization problems, Linear Program, Application: Power allocation in Multi-cell cooperative OFDM

Week 5: Jensen's Inequality, Operations that preserve Convexity, Examples, Beamforming in Multi-antenna Wireless Communication

Week-6: Maximal Ratio Combiner (MRC), Multi-antenna Beamforming

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:

with Interfering User, Zero-Forcing (ZF) beamforming, Robust beamformer Design

Week-7: Optimization for signal estimation, LS, WLS, Regularization. Application: Wireless channel estimation, Image Reconstruction-Deblurring, Representation of Convex Optimization problem

Week 8 : Application: Convex optimization for Machine Learning, Principal Component Analysis (PCA), Support Vector Machines

Week 9- Application: Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation, SVM

Week 10- Application: Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation

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



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



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



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



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

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

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



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



Week 11 :

Application:
Radar for target
detection, Array
Processing,
MUSIC,
MIMO-Radar
Schemes for
Enhanced Target
Detection

Week 12:

Application:
Convex
optimization for
Big Data
Analytics,
Recommender
systems, User
Rating
Prediction and
Optimization for
Finance

Transcripts

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

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

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

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



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



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



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



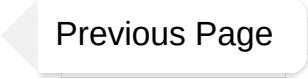
$$\frac{5}{4} \bar{\mathbf{x}}_1 - \frac{1}{4} \bar{\mathbf{x}}_2$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

A button with a left-pointing arrow on the left side and the text "Previous Page" in the center.A button with the text "End" in the center and a right-pointing arrow on the right side.