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

Announcements Course Ask a Question Progress Mentor FAQ

Unit 7 - Week 5: Jensen's Inequality, Operations that preserve Convexity, Examples, Beamforming in Multi-antenna Wireless Communication

Course outline

How to access the portal

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

DOWNLOAD VIDEOS

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-5

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. **Due on 2018-09-12, 23:59 IST.**

1) The set of positive semi-definite matrices is 1 point

- Concave
- Convex
- Affine
- Quasi-concave

No, the answer is incorrect.
Score: 0

Accepted Answers:
Convex

2) Set S is affine if for any two points $\bar{x}_1, \bar{x}_2 \in S$, 1 point

- $\theta \bar{x}_1 + \theta \bar{x}_2 \in S$, for all $\theta \geq 0$
- $\theta \bar{x}_1 + \theta \bar{x}_2 \in S$, for all $1 \geq \theta \geq 0$
- $\theta \bar{x}_1 + (1 - \theta) \bar{x}_2 \in S$, for all $1 \geq \theta \geq 0$
- $\theta \bar{x}_1 + (1 - \theta) \bar{x}_2 \in S$, for all θ

No, the answer is incorrect.
Score: 0

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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

- Lec 27-Jensen's Inequality and Practical Application
- Lec 28-Jensen's Inequality application
- Lec 29 - Properties of Convex Functions
- Lec 30 - Conjugate Function and Examples to prove Convexity of various Functions
- Lec 31- Example problems: Operations preserving Convexity(log-sum, average) and Quasi Convexity
- Lec 32-Example Problems: Verify Convexity, Quasi-Concavity and Quasi-Concavity of functions
- Lec 33-Example

ce De

No, the answer is incorrect.

Score: 0

Accepted Answers:

True

4) The set $\{\bar{x} \in \mathbb{R}^n | \bar{x}^T \bar{y} \leq 1 \text{ for all } \|\bar{y}\| = 1\}$ is convex

1 point

- True
- False

No, the answer is incorrect.

Score: 0

Accepted Answers:

True

5) The set of two-dimensional positive semidefinite matrices $\mathbf{X} = \begin{bmatrix} x & y \\ y & z \end{bmatrix}$ can be equivalently expressed as

1 point

- $\{x, y, z \in \mathbb{R} | x \geq 0, z \geq 0, y \geq 0\}$
- $\{x, y, z \in \mathbb{R} | xz \geq y^2\}$
- $\{x, y, z \in \mathbb{R} | x \geq 0, z \geq 0, xz \geq y^2\}$
- $\{x, y, z \in \mathbb{R}\}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\{x, y, z \in \mathbb{R} | x \geq 0, z \geq 0, xz \geq y^2\}$

6) The set $\left\{ \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \in \mathbb{R}^2 | x_1 x_2 \geq 1 \right\}$ can be expressed as the intersection of infinite number of half-spaces given by

1 point

- $x_1 + x_2 \geq 2\alpha, \alpha \geq 0$
- $\alpha^2 x_2 + x_1 \geq 2\alpha, \alpha \geq 0$
- $\alpha x_2 + x_1 \geq 2\alpha^2, \alpha \geq 0$
- $\alpha x_2 + \alpha^2 x_1 \geq 2, \alpha \geq 0$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\alpha^2 x_2 + x_1 \geq 2\alpha, \alpha \geq 0$

7) The set $\{\bar{x} \in \mathbb{R}^n | \|\bar{x}\|_\infty \leq 1\}$ is a

1 point

- Norm ball
- Norm cone
- Halfspace

Problems:Perspective function,
Product of Convex functions and Pointwise Maximum is Convex

Quiz : Assignment-5

WEEK-5 FEEDBACK

Assignment-5 Solution

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

Polyhedron

No, the answer is incorrect.

Score: 0

Accepted Answers:

Polyhedron

8) Which of the following sets is convex? **1 point**

i. $\left\{ \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \in \mathbb{R}^2 \mid x_1^2 + 2ix_1x_2 + i^2x_2^2 \leq 1 \text{ for } i = 1, 2, \dots, 10 \right\}$

ii. $\{\bar{\mathbf{x}} \in \mathbb{R} \mid \min x_i = 1\}$

i only

ii only

Both i and ii

Neither i nor ii

No, the answer is incorrect.

Score: 0

Accepted Answers:

i only

9) Let X be a real-valued random variable **1 point**

with $\Pr(X = a_i) = p_i, i = 1, 2, \dots, n$. The set of vectors $\bar{\mathbf{p}}$ that satisfy the constraint quartile $(X) \geq \alpha$, where quartile $(X) = \inf\{\beta \mid \Pr(X \leq \beta) \geq 0.25\}$ is

Norm cone

Not-convex

Half-Space

Norm Ball

No, the answer is incorrect.

Score: 0

Accepted Answers:

Half-Space

10)The l_1 norm ball in \mathbb{R}^2 is a **1 point**

Circle with center at origin

Square with sides parallel to axes

Square with diagonals on axes

Hexagon with center at origin

No, the answer is incorrect.

Score: 0

Accepted Answers:

Square with diagonals on axes

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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

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

