

X



reviewer3@nptel.iitm.ac.in ▼

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

Announcements Course Ask a Question Progress Mentor FAQ

# Unit 6 - Week 4 : Convex Optimization problems, Linear Program, Application: Power allocation in Multi-cell cooperative OFDM

## 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 - 4

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) Set  $S$  is convex 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  $\theta$

No, the answer is incorrect. Score: 0

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

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

- Line joining  $\bar{x}_1, \bar{x}_2$  is partly contained in  $S$
- Line joining  $\bar{x}_1, \bar{x}_2$  is fully contained in  $S$
- Line segment between  $\bar{x}_1, \bar{x}_2$  is partly contained in  $S$

© 2014 NPTEL - Privacy & Terms - Honor Code - FAQs -



A project of



In association with



Funded by

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

Lec 19-Norm balls and Matrix properties

Lec 20- Inverse of a Positive Definite Matrix

Lec 21-Example Problems: Property of Norms and Problems on Convex Sets

Lec 22-Problems on Convex Sets(continued)

Lec 23-Introduction to Convex and Concave Functions

Lec 24-Properties of Convex Functions with examples

Lec 25-Test for Convexity: Positive Semidefinite Hessian Matrix

Lec 26-Application: MIMO Receiver Design as a Least Squares Problem

Quiz : Assignment - 4

WEEK-4 FEEDBACK

Assignment-4 Solution

**Week 5: Jensen's Inequality, Operations that preserve**

3) Which of the following sets is convex 1 point

- i. Hyperplane
- ii. Halfspace
- iii. Norm Ball
- iv. Ellipsoid

- Only i,ii,iii
- Only ii,iii,iv
- Only i,iii,iv
- i,ii,iii,iv

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*i,ii,iii,iv*

4) Equivalent representation of a norm ball of radius  $r$  and center  $\bar{\mathbf{x}}_c$  is 1 point

$S = \{\bar{\mathbf{x}}_c + r\bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

$S = \{\bar{\mathbf{x}}_c + r\bar{\mathbf{u}}\}$

$S = \{\bar{\mathbf{x}}_c + r\bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| = 1\}$

$S = \{r\bar{\mathbf{x}}_c + \bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$S = \{\bar{\mathbf{x}}_c + r\bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

5) Equivalent representation of a general ellipsoid with center  $\bar{\mathbf{x}}_c$  is 1 point

$S = \{\mathbf{A}\bar{\mathbf{x}}_c + \bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

$S = \{\bar{\mathbf{x}}_c + \mathbf{A}\bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

$S = \{\mathbf{A} + \bar{\mathbf{x}}_c\bar{\mathbf{u}}^T \mid \|\bar{\mathbf{u}}\| \leq 1\}$

$S = \{\bar{\mathbf{x}}_c + \bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$S = \{\bar{\mathbf{x}}_c + \mathbf{A}\bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$

6) In multi-antenna beamforming, all the beamforming vectors that ensure unity gain for the desired signal lie in a 1 point

- Hyperplane
- Halfspace
- Ellipsoid

Convexity,  
Examples, Beamforming  
in Multi-antenna  
Wireless  
Communication

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, Representatic  
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

Norm Cone

No, the answer is incorrect.

Score: 0

Accepted Answers:

Hyperplane

7) In wireless applications, the true channel vector corresponding to estimated CSI can be modeled to lie in a **1 point**

Hyperplane

Halfspace

Ellipsoid

Norm Cone

No, the answer is incorrect.

Score: 0

Accepted Answers:

Ellipsoid

8) Consider the vector  $\bar{\mathbf{x}} = [x_1 \ x_2 \ \dots \ x_n]^T$ . The norm cone can be represented as the set of vectors **1 point**

$\|\bar{\mathbf{x}}\| \leq r$

$\|\mathbf{A}\bar{\mathbf{x}}\| \leq r$

$\bar{\mathbf{a}}^T \bar{\mathbf{x}} \leq r$

$\| [x_1 \ x_2 \ \dots \ x_{n-1}]^T \| \leq x_n$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\| [x_1 \ x_2 \ \dots \ x_{n-1}]^T \| \leq x_n$

9) A polyhedron is **1 point**

Intersection of hyperplanes only

Intersection of hyperplanes and halfspaces

Intersection of halfspace with an ellipsoid

Intersection of a hyperplane with a norm cone

No, the answer is incorrect.

Score: 0

Accepted Answers:

Intersection of hyperplanes and halfspaces

10) Consider two  $n$  - dimensional points  $\bar{\mathbf{a}}$ ,  $\bar{\mathbf{b}}$  and the set of points closer to  $\bar{\mathbf{a}}$  than  $\bar{\mathbf{b}}$  i.e  $\{\bar{\mathbf{x}} \mid \|\bar{\mathbf{x}} - \bar{\mathbf{a}}\| \leq \|\bar{\mathbf{x}} - \bar{\mathbf{b}}\|\}$ . This set is **1 point**

Concave

Halfspace

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

- Hyperplane
- Ellipsoid

No, the answer is incorrect.

Score: 0

Accepted Answers:

*Halfspace*

Previous Page

End