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

Announcements Course Ask a Question Progress Mentor FAQ

Unit 8 - Week-6: Maximal Ratio Combiner (MRC), Multi-antenna Beamforming with Interfering User, Zero-Forcing (ZF) beamforming, Robust beamformer Design

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-6

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) A function f is convex if for any two points \bar{x}_1, \bar{x}_2 1 point

$$f(\theta\bar{x}_1 + (1 - \theta)\bar{x}_2) \leq \theta f(\bar{x}_1) + (1 - \theta)f(\bar{x}_2), \text{ for all } \theta$$

$$f(\theta\bar{x}_1 + (1 - \theta)\bar{x}_2) \geq \theta f(\bar{x}_1) + (1 - \theta)f(\bar{x}_2), \text{ for all } \theta$$

$$f(\theta\bar{x}_1 + (1 - \theta)\bar{x}_2) \leq \theta f(\bar{x}_1) + (1 - \theta)f(\bar{x}_2), \text{ for all } 1 \geq \theta \geq 0$$

$$f(\theta\bar{x}_1 + (1 - \theta)\bar{x}_2) \geq \theta f(\bar{x}_1) + (1 - \theta)f(\bar{x}_2), \text{ for all } 1 \geq \theta \geq 0$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$f(\theta\bar{x}_1 + (1 - \theta)\bar{x}_2) \leq \theta f(\bar{x}_1) + (1 - \theta)f(\bar{x}_2), \text{ for all } 1 \geq \theta \geq 0$$

2) Which of the following functions is not convex 1 point

$$e^{-ax}, a > 0$$

$$x^\alpha, 0 < \alpha < 1$$

$$-\ln x$$

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National Programme on
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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, 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

Lec 34- Practical Application: Beamforming in Multi-antenna Wireless Communication

Lec 35 - Practical Application: Maximal Ratio Combiner for Wireless Systems

Lec 36- Practical Application: Multi-antenna Beamforming with Interfering User

Lec 37- Practical Application: Zero-Forcing (ZF) Beamforming with Interfering User

Lec 38- Practical

3) A convex function f satisfies

1 point

- $f(y) \leq f(x) + \frac{df(x)}{dx} (y - x)$
- $f(y) = f(x) + \frac{df(x)}{dx} (y - x)$
- $f(y) \geq f(x) - \frac{df(x)}{dx} (y - x)$
- $f(y) \geq f(x) + \frac{df(x)}{dx} (y - x)$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$f(y) \geq f(x) + \frac{df(x)}{dx} (y - x)$$

4) The function $f(\bar{x})$ of a vector \bar{x} is convex if

1 point

- $\nabla^2 f(\bar{x}) \succcurlyeq 0$
- $\nabla^2 f(\bar{x}) \preccurlyeq 0$
- $\nabla^2 f(\bar{x}) = 0$
- $\nabla f(\bar{x}) \nabla^T f(\bar{x}) \succcurlyeq 0$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$\nabla^2 f(\bar{x}) \succcurlyeq 0$$

5) Consider the MIMO wireless system model given by $\bar{y} = \mathbf{H}\bar{x} + \bar{n}$. The quantity $\nabla^2 \|\bar{y} - \mathbf{H}\bar{x}\|^2$ is

1 point

- $2\mathbf{H}\mathbf{H}^T$
- $2(\mathbf{H} + \mathbf{H}^T)$
- $2\mathbf{H}^T\mathbf{H}$
- $(\mathbf{H}^T\mathbf{H})^{-1}\mathbf{H}^T$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$2\mathbf{H}^T\mathbf{H}$$

6) Jensen's inequality for a convex function f and random variable X is

1 point

Application:
Robust
Beamforming
With Channel
Uncertainty for
Wireless
Systems

Lec 39-
Practical
Application:
Robust
Beamformer
Design for
Wireless
Systems

Lec 40 -
Practical
Application:
Detailed
Solution for
Robust
Beamformer
Computation in
Wireless
Systems

Quiz :
Assignment-6

Assignment-6
Solution

WEEK-6
FEEDBACK

**Week-7:Optimization
for signal
estimation, LS,
WLS,
Regularization.
Application:
Wireless
channel
estimation,
Image
Reconstruction-
Deblurring,Representatio
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,**

$f(E\{X\}) \geq E\{f(X)\}$

$f(E\{X\}) \leq E\{f(X)\}$

$f(E\{X\}) \geq f(X)$

$f(E\{X\}) \leq f(X)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$f(E\{X\}) \leq E\{f(X)\}$

7) Let x be a real-valued random variable which takes values in $\{a_1, a_2, \dots, a_n\}$ where $a_1 < a_2 < \dots < a_n$, with $\Pr(x = a_i) = p_i$. The function $\Pr(\alpha \leq x \leq \beta)$ is, **1 point**

Convex

Concave

Quasi-convex

All of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

All of the above

8) The function $f(x_1, x_2) = x_1 x_2$ is **1 point**

Convex

Concave

Quasi-convex

Quasi-concave

No, the answer is incorrect.

Score: 0

Accepted Answers:

Quasi-concave

9) Consider an AWGN communication channel with output $y = x + n$, where the symbols x are drawn from a BPSK constellation of power P and n denotes white Gaussian noise of power σ^2 . The bit-error rate (BER) for this channel as a function of the SNR $\gamma = \frac{P}{\sigma^2}$ is, **1 point**

$Q(\sqrt{\gamma})$

$Q(\gamma)$

$Q^2(\gamma)$

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

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

$$Q^2(\sqrt{\gamma})$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$Q(\sqrt{\gamma})$$

10)The conjugate function $f(\bar{\mathbf{y}})$ of a function $f(\bar{\mathbf{x}})$ is defined as 1 point

$$\max_{\bar{\mathbf{x}}} (\bar{\mathbf{y}}^T \bar{\mathbf{x}} - f(\bar{\mathbf{x}}))$$

$$\max_{\bar{\mathbf{x}}} (f(\bar{\mathbf{x}}) - \bar{\mathbf{y}}^T \bar{\mathbf{x}})$$

$$\max_{\bar{\mathbf{x}}} (f(\bar{\mathbf{x}}) + \bar{\mathbf{y}}^T \bar{\mathbf{x}})$$

$$\min_{\bar{\mathbf{x}}} (f(\bar{\mathbf{x}}) - \bar{\mathbf{y}}^T \bar{\mathbf{x}})$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\max_{\bar{\mathbf{x}}} (\bar{\mathbf{y}}^T \bar{\mathbf{x}} - f(\bar{\mathbf{x}}))$$

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