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

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 $\bar{x}_1, \bar{x}_2$

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

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

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

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

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

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

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

$$-\ln x$$

1 point
3) A convex function $f$ satisfies

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

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

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
$$\nabla^2 f(\bar{x}) \preceq 0$$

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

$$2HH^T$$
$$2(H + H^T)$$
$$2H^TH$$
$$H^T(HH)^{-1}H^T$$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$$2H^TH$$

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

$$f(\mathbb{E}[X]) \leq \mathbb{E}[f(X)]$$

$$f(\mathbb{E}[X]) \geq \mathbb{E}[f(X)]$$
7) Let $x$ be a real-valued random variable which takes values in $\{a_1, a_2, \ldots, a_n\}$ where $a_1 < a_2 < \cdots < a_n$, with $\Pr(x = a_i) = p_i$. The function $\Pr(\alpha \leq x \leq \beta)$ is:

- 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:

- 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 $\sigma^2$. The bit-error rate (BER) for this channel as a function of the SNR $\gamma = \frac{P}{\sigma^2}$ is,

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

$$Q(\gamma)$$

$$Q^2(\gamma)$$
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

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

\[
Q^2(\sqrt{\gamma}) = \max_{\bar{x}} (\bar{y}^T \bar{x} - f(\bar{x}))
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:

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

\[
\max_{\bar{x}} (f(\bar{x}) - \bar{y}^T \bar{x})
\]

\[
\max_{\bar{x}} (f(\bar{x}) + \bar{y}^T \bar{x})
\]

\[
\min_{\bar{x}} (f(\bar{x}) - \bar{y}^T \bar{x})
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:

\[
\max_{\bar{x}} (\bar{y}^T \bar{x} - f(\bar{x}))
\]