Quiz 2_ Linear Algebra, Convexity, Optimality Conditions, Linear Regression_ Machine Learning

Friday, September 30, 2022 2:21 AM

Quiz 2_
Linear...

Quiz 2: Linear Algebra, Convexity, Optimality Conditions, Linear Regression

Due Sep 26 at 11:59pm **Points** 8 **Questions** 8 **Available** Sep 22 at 12am - Sep 26 at 11:59pm
Time Limit None **Allowed Attempts** Unlimited

Take the Quiz Again

Attempt History

	Attempt	Time	Score
KEPT	Attempt 3	2 minutes	8 out of 8
LATEST	Attempt 3	2 minutes	8 out of 8
	Attempt 2	8 minutes	7 out of 8
	Attempt 1	1,536 minutes	5 out of 8

ⓘ Correct answers will be available on Sep 27 at 12am.

Score for this attempt: **8** out of 8
Submitted Sep 23 at 4:05pm
This attempt took 2 minutes.

Question 1 1 / 1 pts

Which of the following statements about the Taylor expansion of a function f is true?

- (selected) The 2nd order Taylor expansion of f involves the Hessian of f. ✓
- The 1st order Taylor expansion of f involves both the gradient and Hessian of f.
- The 2nd order Taylor expansion of f only involves the gradient of f.
- The 1st order Taylor expansion of f involves the Hessian of f.

Question 2 1 / 1 pts

Consider the quadratic form $\vec{x}^\top A\vec{x}$, where $A = \begin{bmatrix} 3 & 0 \\ 0 & -4 \end{bmatrix}$. Which of the following is false?

- There exists $x \neq 0$ such that $\vec{x}^\top A\vec{x} \geq 0$. ✓
- The eigenvalues of A are 3 and -4. ✓
- (selected) $\vec{x}^\top A\vec{x}$ is always non-negative. F
- The matrix A is indefinite. ✓

Question 3 1 / 1 pts

Which of the following functions is convex?

- $f(\vec{x}) = \vec{x}^\top A\vec{x}$ where A is negative definite ✗
- $f(\vec{x}) = \vec{x}^\top A\vec{x}$ where A is indefinite ✗
- $f(x) = x^3$ ✗
- (selected) $f(\vec{x}) = \vec{x}^\top A\vec{x}$ where $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Question 4 1 / 1 pts

Which of the following is true?

- (selected) All eigenvalues of $AA^\top$ are non-negative, for all A. ✓
- A quadratic form $\vec{x}^\top A\vec{x}$ is only well-defined when A is symmetric.
- Any function must be either convex or concave.
- A line joining two points on the surface of a concave function is always on or above the surface.

Question 5 1 / 1 pts

The function $f(x) = U\Lambda U^{-1}$, where $\Lambda = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -0.5 & 0 \\ 0 & 0 & -2 \end{bmatrix}$ is

- positive definite.
- indefinite.
- negative semi-definite but not negative definite.
- (selected) negative definite. ✓

Question 6 1 / 1 pts

A critical point of a function must be a local minimum if

- (selected) the function is convex. ✓
- the Hessian at the critical point is negative semi-definite.
- the Hessian at the critical point is positive semi-definite.
- the function is concave.

Question 7 1 / 1 pts

Which of the following statements is true?

- In a convex function, every local maximum is a global maximum.
- (selected) In a concave function, every local maximum is a global maximum. ✓
- If every local maximum is a global maximum, then the function is concave.

- If every local maximum is a global maximum, then the function is convex.

Question 8 1 / 1 pts

Denote the set of data points as $\{\vec{x}_i, y_i\}_{i=1}^N$ and the weights as $(\vec{w}, b)$. In ordinary least squares, we would like to

- (selected) minimize $L = \sum_{i=1}^N (y_i - (\vec{w}^\top \vec{x}_i + b))^2$ by choosing the optimal $\vec{w}$ and b. ✓
- maximize $L = \sum_{i=1}^N (y_i - (\vec{w}^\top \vec{x}_i + b))^2$ by choosing the optimal set of $\vec{x}_i$ and y_i.
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- minimize$L = \sum_{i=1}^N (y_i - (\vec{w}^\top \vec{x}_i + b))^2$ by choosing the optimal set of $\vec{x}_i$ and y_i.

Quiz Score: **8** out of 8