2/8/2019 Quiz: Homework 1

Homework 1

Started: Feb 8 at 2pm

Quiz Instructions

You may want to refer to the material:

https://github.com/wangshusen/CS583A-2019Spring/blob/master/Reading/MatrixCalculus.pdf

Question 1

3 pts

Let $\mathbf{x} = [3, -10, 9, 0, -2]$ be a 5-dimensional vector.

What is $\|\mathbf{x}\|_2^2$ (i.e., the squared ℓ_2 -norm of \mathbf{x})?

Question 2

3 pts

Let $\mathbf{x} = [3, -10, 9, 0, -2]$ be a 5-dimensional vector.

What is $\|\mathbf{x}\|_1$ (i.e., the squared ℓ_1 -norm of \mathbf{x})?



Question 3

3 pts

Let $\mathbf{x} = [3, -10, 9, 0, -2]$ be a 5-dimensional vector.

What is $\|\mathbf{x}\|_{0.5}$ (i.e., the squared ℓ_p -norm of \mathbf{x} with p=0.5)?

Question 4

3 pts

Let $\mathbf{x} = [3, -10, 9, 0, -2]$ and $\mathbf{a} = [0, 9, -3, -2, 1]$ be 5-dimensional vectors.

What is the inner product $\mathbf{a}^T \mathbf{x}$?



Question 5

3 pts

Let $\mathbf{x} = [3, -10, 9, 0, -2]$ be a 5-dimensional vector.

What is $\|\mathbf{x}\|_{\infty}$ (i.e., the squared $\boldsymbol{\ell}_{\infty}$ -norm of \mathbf{x})?

Question 6

3 pts

Define the matrix $\mathbf{A} = egin{bmatrix} -1 & 0 & 2 \ 4 & -5 & 3 \end{bmatrix}$.

The matrix $\mathbf{A}^T\mathbf{A}$ is symmetric.

True

False

Question 7

3 pts

Define the matrix $\mathbf{A} = \begin{bmatrix} -1 & 0 & 2 \\ 4 & -5 & 3 \end{bmatrix}$.

The matrix **A** is symmetric.

- True
- False

Question 8

3 pts

Define the following matrix and vector:

$$\mathbf{A} = egin{bmatrix} -1 & 0 & 2 \ 4 & -5 & 3 \end{bmatrix}$$
 and $\mathbf{b} = egin{bmatrix} 5 \ 6 \ 7 \end{bmatrix}$.

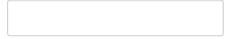
What is the first entry of the vector \mathbf{Ab} ?

Question 9

3 pts

Define the matrix ${f A}=egin{bmatrix} -1 & 0 & 2 \ 4 & -5 & 3 \end{bmatrix}$.

What is $\|\mathbf{A}\|_F^2$ (i.e., the squared Frobenius norm of \mathbf{A})?



Question 10

3 pts

Define the matrix $\mathbf{A} = \begin{bmatrix} -1 & 0 & 2 \\ 4 & -5 & 3 \end{bmatrix}$.

What is $tr(\mathbf{A}^T\mathbf{A})$ (i.e., the trace of $\mathbf{A}^T\mathbf{A}$)?



Question 11

12 pts

Let
$$\mathbf{x} = [x_1, x_2, x_3]$$
 and $y = rac{x_1^2}{2} + \log_e(x_2) - rac{x_1}{x_3}$.

Question: What is the value of $\frac{\partial y}{\partial \mathbf{x}}$ at $\mathbf{x} = \left[9, 1, \frac{1}{2}\right]$?

Answer: It is the vector [, ,]

Hint: The value of $\left. \frac{\partial \log_e(z)}{\partial z} \right.$ at z=1 is $\left. \frac{\partial \log_e(z)}{\partial z} \right|_{z=1} = \frac{1}{z} \right|_{z=1} = 1$.

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A dataset has 100 positive samples and 100 negative samples. Furthermore,

#True Positive = 63,

#False Negative = 37,

#True Negative = 72,

#False Positive = 28.

What is the False Positive Rate?

8 pts

Question 14 5 pts

Let x be a scalar variable and $f(x)=3x^2+36x-8$. Let x^\star be the optimal solution to the problem $\min_x f(x)$.

What is the value of \boldsymbol{x}^{\star} ? (Hint: \boldsymbol{f} is a convex function; use the first-order optimality condition.)

1
1
1
1
1
J

Question 15

5 pts

Let x be a scalar variable and f(x) = -2x + 10.

What is the value of $\min_x f(x)$ s.t. $-2 \le x \le 5$?

Question 16

32 pts

Are all of the following statements true?

- On Jan 31, the class will be canceled.
- On Jan 31 and Feb 28, the classes and office hours will be canceled.
- There is a quiz on Feb 28.

(Note: This question is a bonus for paying attention to the schedule.)

- True
- False

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Not saved

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