

20W-COMSCIM146 quiz

TOTAL POINTS

22 / 22

QUESTION 1

1 1a 2 / 2

✓ + 2 pts Correct

+ 1 pts [Click here to replace this description.](#)

+ 0 pts [Click here to replace this description.](#)

QUESTION 2

2 1b 2 / 2

✓ + 2 pts Correct

+ 1 pts [Click here to replace this description.](#)

+ 0 pts [Click here to replace this description.](#)

QUESTION 3

3 1c 2 / 2

✓ + 2 pts Correct

+ 0 pts [Click here to replace this description.](#)

QUESTION 4

4 2 6 / 6

✓ - 0 pts Correct

QUESTION 5

5 3a 2 / 2

✓ - 0 pts Correct

QUESTION 6

6 3b 2 / 2

✓ - 0 pts Correct

QUESTION 7

7 3c 2 / 2

✓ - 0 pts Correct

QUESTION 8

8 4 4 / 4

✓ - 0 pts Correct

Math mini-quiz

CM146 math mini-quiz

Winter 2020

Name: _____

UCLA ID: _____

Instructions:

- (a) The time limit for the exam is 30 minutes.
- (b) This exam is CLOSED BOOK and CLOSED NOTES.
- (c) You may use scratch paper if needed.
- (d) This exam contains four questions.
- (e) Mark your answers ON THE EXAM ITSELF IN THE SPACE GIVEN. If you make a mess, clearly indicate your final answer (box it).

1 Calculus

- (a) (2 pts) Let function $f(\mathbf{x}) = \|\mathbf{x}\|_2$. Here \mathbf{x} is a length- n vector (x_1, \dots, x_n) and $\|\mathbf{x}\|_2 = \sqrt{\sum_i x_i^2}$. What is the partial derivative of f with respect to x_1 ?

$$\frac{1}{2} \left(\sum_i x_i^2 \right)^{-1/2} (2x_1)$$
$$= \frac{x_1}{\sqrt{\sum_i x_i^2}}$$

- (b) (2 pts) Evaluate $\int_b^\infty x \exp(-x^2) dx$. Remember $\exp(x) \equiv e^x$.

Let $e^{-x^2} = u$
then $-2x e^{-x^2} dx = du$

$$- \int_b^\infty \frac{1}{2} du = -\frac{1}{2} \left[e^{-x^2} \right]_b^\infty$$
$$= -\frac{1}{2} \left[0 - e^{-b^2} \right] = \boxed{\frac{e^{-b^2}}{2}}$$

- (c) (2 pts) What is the gradient of $f(x, y) = \exp(x) + 2xy$, $\nabla f(x, y) = ?$

- (a) $\begin{bmatrix} \exp(x) \\ y \end{bmatrix}$
- (b) $\begin{bmatrix} \exp(x) + 2y \\ 2x \end{bmatrix}$
- (c) $\begin{bmatrix} \exp(x) + 2x \\ y \end{bmatrix}$
- (d) $\begin{bmatrix} \exp(x) + 2y \\ 2y \end{bmatrix}$

$$e^x + 2xy$$
$$e^x + 2y$$
$$2x$$

2 Probability

(a) (2 pts) Given random variables X_1, X_2 , let $Y = X_1 + X_2$. Then $\mathbb{E}[Y] = \mathbb{E}[X_1] + \mathbb{E}[X_2]$.

True

False

(b) (2 pts) Given random variables X_1, X_2 , let $Y = X_1 + X_2$. Then $\text{Var}[Y] = \text{Var}[X_1] + \text{Var}[X_2] + 2 \text{cov}$

True

False

(c) (2 pts) Suppose A and B are two disjoint events. Then $P(A \cup B) = P(A) + P(B)$.

True

False

3 Linear algebra

Consider the vector $x = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

(a) (2 pts) Compute $x^T x$.

$$x^T x = (1 \ 2) \begin{pmatrix} 1 \\ 2 \end{pmatrix} = 1 + 4 = \boxed{5}$$

(b) (2 pts) Compute $\|x\|_2$.

$$\sqrt{\sum_i x_i^2} = \sqrt{1^2 + 2^2} = \boxed{\sqrt{5}}$$

(c) (2 pts) Compute xx^T .

$$xx^T = \begin{pmatrix} 1 \\ 2 \end{pmatrix} (1 \ 2) = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$$

4 Algorithms

Consider the $m \times n$ matrix A and the n -dimensional vector x . What is the time complexity in Big-O notation of computing:

(a) (2 pts) Ax

$$\begin{array}{ccc} 1 & 2 & 3 \\ 2 & 1 & 2 \\ & & 3 \end{array}$$

$$O(mn)$$

(b) (2 pts) $x^T x$

$$O(n)$$