

ECE 901: Quiz 0

Name:
Dept:

Email:
Year:

Question 1. Give an example of a non-convex, non-concave function f . (may draw if you like)
Answer:

Question 2. Give an example of a function $f : \mathbb{R}^d \rightarrow \mathbb{R}$ that is non-negative everywhere and is also convex.
Answer:

Question 3. Let \mathbf{x} be a $d \times n$ matrix. What are the dimensions of $\mathbf{x}^T \mathbf{A} \mathbf{y} + \mathbf{B} \mathbf{x}$?
Answer:

Question 4. What are the eigenvalues, eigenvectors, and determinant of the matrix $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$?
Answer:

Question 5. Let X be a real, discrete, random variable. If $\mathbb{E}(|X|^3) = 0$, what can you say about X ?
Answer:

Question 6. Let X_1, \dots, X_n be independent, zero-mean, Gaussian random variables with variance 1, and $Z = \sum_{i=1}^n X_i$. Please compute: i) $\mathbb{E}\{Z\}$, ii) $\text{var}\{Z\}$, and iii) $\mathbb{E}\{Z|X_2, \dots, X_n\}$.
Answer:

Question 7. Let a coin with 2/3 probability of turning heads (H), and 1/3 tails (T). What is the most likely sequence of events after 5 random tosses?
Answer:

Question 8. What is the complexity of multiplying matrices $\mathbf{A} \in \mathbb{R}^{n \times d}$ and $\mathbf{B} \in \mathbb{R}^{d \times m}$? (in terms of scalar multiplications)
Answer:

Question 9. Let $c_i \in \mathbb{R}$. Can you solve the following in polynomial time in n ? If so, how? If not, why?

$$\max_{x_i \in \{-1, +1\}} \left| \sum_{i=1}^n c_i \cdot x_i \right|$$

Answer: