

AI1110 Assignment 10

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Abstract

This document contains problem of chapter 7 in papoullis textbook

Problem

Chapter 7-7.9

Show that if

$$x_i \geq 0, E(x_i^2) = M \text{ and } s = \sum_{i=1}^n x_i \quad (1)$$

then,

$$E(s^2) \leq ME(n^2) \quad (2)$$

Solution

① Simplify $E(s^2)$

$$E(s^2 | n = n) = E\left(\left(\sum_{i=1}^n x_i^2\right)\right) \quad (3)$$

$$= E\left(\sum_{j=1}^n \sum_{i=1}^n x_i x_j\right) \quad (4)$$

$$(5)$$

② Triangle Inequality

$$E(x_i x_j)^2 \leq E(x_i^2) E(x_j^2) \quad (6)$$

$$\leq M^2 \quad (7)$$

L^AT_EX

final Result

- ① Let us Apply the Above inequality in the question

$$E \left(\sum_{j=1}^n \sum_{i=1}^n x_i x_j \right) \leq M^2 \times n^2 \quad (8)$$

$$E (s^2) = E (E (s^2 | n = n)) \quad (9)$$

$$= E (M^2 (n^2)) \quad (10)$$

$$= M^2 E (n^2) \quad (11)$$