

605 - Week 7 Discussion

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Homework Week 7

Problem 9: Let X , Y , and Z be independent random variables, each with mean μ and variance σ^2

- (a) Find the expected value and variance of $S = X + Y + Z$. The expected value of S is: *The expected value of S can be found using the definition of Theorem 6.9 (Introduction of Probability):*

$$E(S_n) = n\mu$$

Therefore, the expected value of S (sum), when $n = 3$, is equal to:

$$E(S) = 3\mu$$

The variance of S is: *The variance of S (sum) can be found using the definition of Theorem 6.9 (Introduction of Probability):*

$$V(S_n) = n\sigma^2$$

Therefore, the variance of S , when $n = 3$, is equal to:

$$V(S) = 3\sigma^2$$

- (b) Find the expected value and variance of $A = (1/3)(X + Y + Z)$. The expected value of A is: *Using the same theorem from part a we can find the expected value of A (average).*

$$E(A) = \mu$$

The variance of A (average) using the definition of Theorem 6.9 :

$$V(A_n) = \frac{\sigma^2}{n}$$

*Therefore, the variance when $n = 3$ is :

$$V(A) = \frac{\sigma^2}{3}$$

- (c) Find the expected value of S^2 and A^2 *We will use the definition of Theorem 6.15:*

$$V(X) = E(X^2) - \mu^2$$

solving for $E(X^2)$.

$$E(X^2) = V(X) + \mu^2$$

Then the expected value of S^2 is:

$$E(S^2) = 3\sigma^2 + (3\mu)^2 = 3\sigma^2 + 9\mu^2$$

Then the expected value of A^2 is:

$$E(A^2) = \frac{\sigma^2}{3} + \mu^2$$