Sample Questions: Expected Value, Variance and Covariance

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1. Let X have a continuous uniform distribution on (L, R). Calculate $E(X)$.

2. Recall that a fair game is one with expected value zero. You wager one dollar, and toss a coin with $P(\text{Head}) = \theta$. If it's heads, you win. In dollars, what should the payoff be so that the game is fair?

3. Let $X \sim \text{Poisson}(\lambda)$. Calculate $E(X)$.

4. Let the continuous random variable X have density $f_X(x) = \begin{cases} \frac{\alpha}{x^{\alpha+1}} & \text{for } x \geq 1 \\ 0 & \text{otherwise} \end{cases}$

Where $\alpha > 0$.

(a) Verify that $f_X(x)$ integrates to one.

(b) Calculate $E(X)$. For what values of α does $E(X)$ exist?

5. Let $X \sim N(\mu, \sigma^2)$. Calculate $E(X)$.

6. Let X have a Gamma distribution with parameters α and λ. Calculate $E(X^k)$.

7. Prove $Var(bX) = b^2 Var(X)$.

8. Show $Var(X) = E(X^2) - [E(X)]^2$.

9. Let X have density e^{-x} for $x \geq 0$ and zero otherwise. Calculate $Var(X)$.

10. Let $X \sim N(\mu, \sigma^2)$. Calculate $Var(X)$.

11. Show $Cov(X, Y) = E(XY) - E(X)E(Y)$.

12. Let X and Y be independent (continuous) random variables. Show $E(XY) = E(X)E(Y)$.

13. If X and Y are independent, $Cov(X, Y) =$
