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NPTEL

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Courses » Introduction to Probability Theory and Stochastic Processes

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Unit 5 - Week 3

Course outline

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Week 0: Review Assignment

Week 1

Week 2

Week 3

- Lecture 7: Mean and Variance
- Lecture 7: Mean and Variance Continued
- Lecture 8: Higher Order Moments and Moments Inequalities
- Lecture 8: Higher Order Moments and Moments Inequalities Continued
- Lecture 9: Generating Functions
- Lecture 9: Generating

Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-09-05, 23:59 IST.

Each of the following questions has four options out of which one or more options can be correct. Individual marks are mentioned corresponding to each question. In case of multiple answers no partial marks will be awarded if all the correct choices are not selected. 0 marks for questions not attempted.

1) Let X be a random variable with finite moments and $a, s \in \mathcal{R}$, where $s > 0$. Then, identify the correct statements. *2 points*

- $P(X \geq a) \leq \frac{E[e^{sX}]}{e^{sa}}$
- $P(X \geq a) \geq \frac{E[e^{sX}]}{e^{sa}}$
- $P(X \geq a) \leq \frac{E[e^{sX}]}{e^{2a}}$
- $P(X \geq a) \geq \frac{E[e^{sX}]}{e^{2a}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$P(X \geq a) \leq \frac{E[e^{sX}]}{e^{sa}}$

2) Let X be a discrete random variable with probability mass function defined as *2 points*

$$P(X = j) = \frac{\theta^j}{2^j\, f(\theta)}\ ,\ j = 0, 1, 2, \ldots,\quad 0 < \theta < 2$$

where

$$f(\theta) = \sum_{j=0}^{j=\infty} \frac{\theta^j}{2^j}\ .$$

Then which of the following statements about the PGF $(P(s))$ and MGF $(M(t))$ of

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Week 12: Markovian Queueing Models

$$P(s) = \frac{f(s\theta)}{f(\theta)}\ ,\ |s| < \frac{2}{\theta}$$
$$M(t) = \frac{f(e^t\theta)}{f(\theta)}\ ,\ |t| < \log\left(\frac{2}{\theta}\right)$$

$$P(s) = \frac{f(\frac{s\theta}{2})}{f(\theta)}\ ,\ s < \frac{2}{\theta}$$
$$M(t) = \frac{f(\frac{e^t\theta}{2})}{f(\theta)}\ ,\ t < \log\left(\frac{2}{\theta}\right)$$

$$P(s) = \frac{f(s\theta)}{f(\theta)}\ ,\ |s| < \frac{2}{\theta}$$
$$M(t) = \frac{f(e^t\theta)}{f(\theta)}\ ,\ t < \log\left(\frac{2}{\theta}\right)$$

$$P(s) = f(s\theta),\ s < \frac{2}{\theta}$$
$$M(t) = f(e^t\theta),\ t < \log\left(\frac{2}{\theta}\right)$$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$$P(s) = \frac{f(s\theta)}{f(\theta)}\ ,\ |s| < \frac{2}{\theta}$$
$$M(t) = \frac{f(e^t\theta)}{f(\theta)}\ ,\ t < \log\left(\frac{2}{\theta}\right)$$

3) The MGF of a discrete random variable Y is given by $M_Y(t) = \frac{1}{10}\,e^{-3t} + \frac{1}{5}\,e^{-t} + \frac{2}{5} + \frac{3}{10}\,e^{2t}$. Identify the TRUE statements. ***1 point***

$P(Y > 0) = \frac{7}{10}$

$E(Y) = \frac{11}{10}$

$Var(Y) = \frac{109}{100}$

$E(Y^3) = -\frac{5}{10}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E(Y^3) = -\frac{5}{10}$

4) Suppose that two teams are playing a series of games, each of which is independently won by team A and team B. The winner of the series is the first team to win four games. If probability of A winning a game is 0.4 and hence of B winning is 0.6, then, find the expected number of games that are played. ***2 points***

$\frac{15625}{3125}$

$\frac{17804}{3125}$

$\frac{20937}{3125}$

$\frac{16804}{3125}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{17804}{3125}$

5) Let X be a continuous random variable with probability density function f given by: ***1 point***

$$f(x) = \begin{cases} |\frac{1}{16}(4-x)| & 0 \leq x \leq 8 \\ 0 & \text{othervise} \end{cases}$$

Then, $E(X^2)$ is equal to:

$\frac{4}{3}$

$\frac{64}{3}$

24

4

No, the answer is incorrect.
Score: 0

Accepted Answers:
24

6) A certain alloy is formed by combining the melted mixture of two metals. The resulting alloy contains a certain percent of lead, say X, which may be considered as a random variable. Suppose that X has the following probability density function: ***2 points***

$$f(x) = \begin{cases} 6 \times 10^{-6} x(100-x) & 0 \leq x \leq 100 \\ 0 & \text{otherwise} \end{cases}.$$

Suppose that P, the net profit realized in selling this alloy per pound, is the following function of the percent content of lead: $P = C_1 + C_2 X$. Then, find the variance of the profit P.

$C_1 + 50C_2$

$C_1^2 + 500C_2^2$

$500C_2^2$

$3000C_2^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$500C_2^2$

7) Suppose that the number of people who visits a hospital on any day is a random variable ***1 point***

with mean 50 and standard deviation 5. Find the lower bound for the probability that there will be more than 40 but fewer than 60 people in the hospital?

$\frac{1}{4}$

$\frac{3}{4}$

$\frac{2}{3}$

$\frac{1}{2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{3}{4}$

8) The moment generating function of a random variable X is given by $M_X(t) = e^{\mu(e^t-1)}$. ***2 points***
Then, which of the following statements are NOT TRUE.

$E(X) = \mu$

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

$Var(X) = \mu$

$E(X^3) = \mu^3$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E(X^2) = \mu^2$
$E(X^3) = \mu^3$

9) If X is a random variable with probability density ***2 points***
function $f_X(x) = \frac{k\alpha^k}{(x+\alpha)^{k+1}}$, $x > 0,$ α is a constant such that $\alpha \geq 1$and k is a positive integer.
Then, which of the following statements are TRUE.

$E(X^n)$ exists for all $n \in \{1, 2, 3, \ldots\}$.

$E(X^n)$ exists for all $n \in \{1, 2, 3, \ldots\}$ such that $n < k$.

$E(X^2) = 2$ where $\alpha = 1$ and $k = 2$.

$E(X^3) = 1$ where $\alpha = 1$ and $k = 4$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E(X^n)$ exists for all $n \in \{1, 2, 3, \ldots\}$ such that $n < k$.
$E(X^3) = 1$ where $\alpha = 1$ and $k = 4$.

10) Consider a random variable X with $E(X) = 1$ and $E(X^2) = 1$. Identify the FALSE statements. ***2 points***

- [ ] The moment generating function for the random variable X does not exist.
- [ ] X is a discrete type random variable with $P(X = 0) = 0.5, P(X = 2) = 0.5$.
- [ ] $P(-\frac{1}{2} < X \leq 3) = 1$
- [ ] $E[(X - E(X))^4] = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
The moment generating function for the random variable X does not exist.
X is a discrete type random variable with $P(X = 0) = 0.5, P(X = 2) = 0.5$.

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