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NPTEL

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Unit 6 - Week 4

Course outline

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- Lecture 10: Common Discrete Distributions
- Lecture 10: Common Discrete Distributions Continued
- Lecture 11: Common Continuous Distributions
- Lecture 11: Common Continuous Distributions Continued
- Lecture 12: Applications of Random Variable
- Lecture 12: Applications of Random Variable Continued
- Quiz : Assignment 4
- Assignment 4 Solutions

Week-5 Higher Dimensional Distributions

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Assignment 4

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 the 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) A student arrives to the bus stop at 7:00 AM sharp, knowing that the bus will arrive in any moment, uniformly distributed between 7:00 AM and 7:15 AM. Identify the TRUE statements. ***2 points***

- The probability that the student must wait more than five minutes is $\frac{5}{15}$.
- If the bus has not arrived by 7:05 AM, then, the probability that the student has to wait at least five more minutes is $\frac{5}{15}$.
- If on a particular day the student got late by 5 minutes, then, the probability of the student missing the bus is $\frac{10}{15}$.
- If on a particular day the student got late by 5 minutes, then, the probability of the bus not arriving in next 5 minutes is $\frac{10}{15}$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
If on a particular day the student got late by 5 minutes, then, the probability of the bus not arriving in next 5 minutes is $\frac{10}{15}$.

2) Consider the marks of a NPTEL examination. Suppose that marks are distributed normally with mean 70 and standard deviation 10. 5% of the students obtained A as grade and 10% of the students failed in the course. ***2 points***

Let $Z \sim N(0,1)$ and $\Phi(z) = P(z \leq z)$ with $\Phi(-2.2) = 0.0139,\ \Phi(-1.4) = 0.0808,\ \Phi(-0.8) = 0.2119,\ \Phi(-0.6) = 0.2743,$
$\Phi(-0.4) = 0.3446,\ \Phi(-0.2) = 0.4207,\ \Phi(-1.282) = 0.1,\ \Phi(1.2) = 0.889\ \Phi(1.6$
and $\Phi(-z) = 1 - \Phi(z)$, then identify the TRUE statements.

- The minimum marks to obtain A as a grade is 86.45.
- The minimum marks to pass the course is 45.18.
- The probability of scoring more than 82 marks is 0.2743.
- The probability of scoring less than 64 marks is 0.6554.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The minimum marks to obtain A as a grade is 86.45.

3) Let X follows the distribution N(4,25) and Y be the random variable obtained by truncating X to the left at X = -3 and to the right at X =15, that is, the new random variable Y is bounded below by -3 and above by 15. Using the $\Phi(z)$ values given in Question 2, the probability of Y>5 is equal to (answer up to four decimal places) ***2 points***

- 0.3457
- 0.4493
- 0.5672
- 0.8

No, the answer is incorrect.
Score: 0

$E\left(\frac{1}{X+1}\right) = \frac{1-p^{n+1}}{p}$.

$E\left(\frac{1}{X+1}\right) = \frac{1-(1-p)^{n+1}}{(n+1)p}$.

$E\left(\frac{1}{X+1}\right) = \frac{1-(1-p)^{n}}{np}$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E\left(\frac{1}{X+1}\right) = \frac{1-(1-p)^{n+1}}{(n+1)p}$.

5) The number of times that an individual contracts viral infection in a given year is a Poisson random variable with parameter $\lambda = 4$. Suppose that a new drug has just been marketed that reduces the Poisson parameter λ to 1 for 75% of the population. For the other 25% of the population, the drug has no appreciable effect on the viral infection. If an individual does not get viral infection for a year, what is the probability that he/she followed the new health scheme? ***2 points***

0.75

$\frac{0.75}{0.75+0.25e^{-3}}$

$\frac{0.25}{0.25+0.75e^{-3}}$

$\frac{0.25}{0.25+0.75e^{-1}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{0.75}{0.75+0.25e^{-3}}$

6) An oil company conducts a geological study that indicates that an exploratory oil well should have a 20% chance of striking oil. What is the probability that the third strike comes on the seventh well drilled? ***2 points***

$\frac{5376}{78125}$

$\frac{256}{78125}$

$\frac{1792}{15625}$

$\frac{768}{15625}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{768}{15625}$

7) Let X be a exponentially distributed random variable with mean 10. If $Y = \max\{5, \min\{10, X\}\}$ and $F_Y(y)$ denotes the probability (cumulative) distribution function of Y, then, identify the TRUE statements. ***2 points***

$$F_Y(y) = \begin{cases} 0 & y < 5 \\ 1 - e^{-\frac{x}{10}} & 5 \le y < 10 \\ 1 & 10 \le y \end{cases}$$

$$F_Y(y) = \begin{cases} 0 & y < 5 \\ 1 - e^{-10x} & 5 \le y < 10 \\ 1 & 10 \le y \end{cases}$$

$$F_Y(y) = \begin{cases} 0 & y < 5 \\ e^{-\frac{1}{2}} - e^{-\frac{x}{10}} & 5 \le y < 10 \\ 1 & 10 \le y \end{cases}$$

$$F_Y(y) = \begin{cases} 0 & y < 5 \\ 2 - e^{-\frac{1}{2}} - e^{-\frac{x}{10}} & 5 \le y < 10 \\ 1 & 10 \le y \end{cases}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$F_Y(y) = \begin{cases} 0 & y < 5 \\ 1 - e^{-\frac{x}{10}} & 5 \le y < 10 \\ 1 & 10 \le y \end{cases}$$

8) Let X be exponentially distributed random variable with parameter $\lambda > 0$. Identify the TRUE statements. **2 points**

- [ ] $P(|X-3| > 1 \mid X > 1.5) = 1 - e^{-0.5\lambda} + e^{-2.5\lambda}$
- [ ] $P(|X-1| > 1 \mid X > 1) = e^{-\lambda}$
- [ ] $P(X > s \mid X > t) = P(X > s),\ \forall\, s \ge 0, t \ge 0$
- [ ] $P(X < s \mid X > t) = P(X < s - t),\ \forall\, 0 \le t \le s$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$P(|X-3| > 1 \mid X > 1.5) = 1 - e^{-0.5\lambda} + e^{-2.5\lambda}$
$P(|X-1| > 1 \mid X > 1) = e^{-\lambda}$
$P(X < s \mid X > t) = P(X < s - t),\ \forall\, 0 \le t \le s$

9) Let X be a random variable with $N(0, \sigma^2)$. Identify the TRUE statements. **2 points**

- [ ] $E(X^{2n}) = \frac{(2n)!}{2^n (n)!}\sigma^{2n},\ \text{for } n \in \{0,1,2,\ldots\}$
- [ ] $E(X^{2n}) = \frac{(2n-1)!}{2^{n-1}(n-1)!}\sigma^{2n},\ \text{for } n \in \{1,2,\ldots\}$
- [ ] $E(X^{2n+1}) = 0,\ \text{for } n \in \{0,1,2,\ldots\}$
- [ ] $\text{If } Y = \frac{X}{\sigma} - 2,\ \text{then } P(Y > 2) = 0.5$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E(X^{2n}) = \frac{(2n)!}{2^n (n)!}\sigma^{2n},\ \text{for } n \in \{0,1,2,\ldots\}$
$E(X^{2n}) = \frac{(2n-1)!}{2^{n-1}(n-1)!}\sigma^{2n},\ \text{for } n \in \{1,2,\ldots\}$
$E(X^{2n+1}) = 0,\ \text{for } n \in \{0,1,2,\ldots\}$

10) Let X be a Poisson random variable with parameter λ. Identify the TRUE statements. **2 points**

- [ ] $P(X = k) < P(X = l)$ for $k, l \in \{0,1,2,3,\ldots\}$ and $k < \lambda < l$
- [ ] $P(X = k) < P(X = l)$ for $k, l \in \{0,1,2,3,\ldots\}$ and $k < l < \lambda$
- [ ] $P(X = k) < P(X = l)$ for $k, l \in \{0,1,2,3,\ldots\}$ and $\lambda < k < l$
- [ ] $P(X = k) > P(X = l)$ for $k, l \in \{0,1,2,3,\ldots\}$ and $\lambda < k < l$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$P(X = k) < P(X = l)$ for $k, l \in \{0,1,2,3,\ldots\}$ and $k < l < \lambda$
$P(X = k) > P(X = l)$ for $k, l \in \{0,1,2,3,\ldots\}$ and $\lambda < k < l$

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