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NPTEL

reviewer3@nptel.iitm.ac.in ▼

Courses » Introduction to Probability Theory and Stochastic Processes

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Unit 10 - Week 8

Course outline

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• Modes of convergence

• Modes of convergence continued

• Law of large numbers

• Central limit theorem

• Central limit

Assignment 8

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment.

Due on 2018-09-26, 23:59 IST.

1) Let X_1, X_2, \dots , be a sequence of i.i.d. random variables such that $X_i \sim \exp(1)$. Define

$S_n = \sum_{i=1}^n X_i^2$, $n \geq 1$. Then, $\frac{S_n}{n}$ converges in probability to

2 points

☐ 0

☐ 0.5

☐ 1

☐ 2

No, the answer is incorrect.

Score: 0

Accepted Answers:

2

2) Let X_1, X_2, \dots , be a sequence of i.i.d. random variables with pdf given by

$$f(x) = \begin{cases} \frac{8}{3} x^3 e^{-2x} & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

Define $S_n = \sum_{i=1}^n X_i$, $n \geq 1$. Then, $\lim_{n \rightarrow \infty} P(S_n \leq 3n)$ equals

2 points

☐ 0

☐ 0.5

☐ 1

☐ Does not exist

No, the answer is incorrect.

Score: 0

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Week 9

Week 10

Week 11

Week 12:
Markovian
Queueing
Models

ce De

☐ 0☐ 0.5☐ 1☐ Does not exist.**No, the answer is incorrect.****Score: 0****Accepted Answers:**

0.5

4) Let X_1, X_2, \dots , be a sequence of i.i.d. random variables such that $X_i \sim N(0, 4)$. **2 points**

Define

$$S_n = \sum_{i=1}^n \frac{X_i^2}{n}, \quad n \geq 1.$$

Which of the following statements are correct?

☐ $\sqrt{n}(S_n - 4)$ converges in distribution to $N(0, 4)$ ☐ S_n converges to 4 in probability☐

$$\lim_{n \rightarrow \infty} n \text{Var}(S_n) = 32$$

☐ S_n converges in distribution to $N(0, 1)$ **No, the answer is incorrect.****Score: 0****Accepted Answers:** S_n converges to 4 in probability

$$\lim_{n \rightarrow \infty} n \text{Var}(S_n) = 32$$

5) Suppose that 30 electronic devices say D_1, D_2, \dots, D_{30} are used in the following **2 points**manner. As soon as D_1 fails, D_2 becomes operative. When D_2 fails, D_3 becomes operative etc. Assume that the time to failure of D_i is an exponentially distributed randomvariable with parameter $=0.1(\text{hour})^{-1}$. Let T be the total time of operation of the 30 devices. What is the probability that T exceeds 350 hours?☐ 0.18☐ 0.82☐ 0.3☐ 0.7**No, the answer is incorrect.****Score: 0****Accepted Answers:**

0.18

6) Consider polling of n voters and record the fraction S_n of those polled who are in favour **2 points**of a particular candidate. If p is the fraction of the entire voter population that supports this candidate,then $S_n = \frac{X_1 + X_2 + \dots + X_n}{n}$, where X_i are independent Bernoulli distributed random variables withparameter p . What is the minimum number of voters to be sampled so that we wish our estimate S_n to be within 0.01 of p with probability at least 0.95?☐ 1000

- ☐ 50000
- ☐ 100000
- ☐ 30

No, the answer is incorrect.

Score: 0

Accepted Answers:

50000

7) Let $X_n \sim \chi^2(n)$, $n = 1, 2, \dots$. Then, limiting distribution of $\frac{X_n}{n^2}$ is

2 points

- ☐ $N(0, 1)$
- ☐ degenerate at 0
- ☐ $N(1, 2)$
- ☐ degenerate at 1

No, the answer is incorrect.

Score: 0

Accepted Answers:

degenerate at 0

8) For each $n \geq 1$, let X_n be an uniformly distributed random variable over set $\left\{0, \frac{1}{n}, \frac{2}{n}, \dots, \frac{n-1}{n}, 1\right\}$. Let X_n converges in distribution to a random variable X . Which of the following statements are correct about X ? 2 points

- ☐ $E(X) = \frac{1}{2}$
- ☐ $X \sim U(0, 1)$
- ☐ $E(X) = 0$
- ☐ $P(X > \frac{1}{2}) = 0.25$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$E(X) = \frac{1}{2}$

$X \sim U(0, 1)$

9) Let X_1, X_2, \dots , be a sequence of random variables such that $P(X_n = 0) = 1 - \frac{1}{n}, P(X_n = n) = \frac{1}{n}$. Which of the following statements are correct? 2 points

- ☐ X_n converges to 0 in probability
- ☐ X_n does not converge to 0 in probability
- ☐ $E(X_n) = 1$
- ☐ X_n converges in distribution to a degenerate random variable

No, the answer is incorrect.

Score: 0

Accepted Answers:

X_n converges to 0 in probability

$E(X_n) = 1$

X_n converges in distribution to a degenerate random variable

10) Let X_1, X_2, \dots be a sequence of random variables such that
 $P(X_n = 0) = 1 - \frac{1}{n}, P(X_n = 1) = \frac{1}{n}$.

2 points

Which of the following statements are correct?

☐

X_n converges to 0 almost surely

☐

X_n does not converge in distribution

☐

$E(X_n) = 1$

☐

X_n converges 0 in 2nd mean

No, the answer is incorrect.

Score: 0

Accepted Answers:

X_n converges 0 in 2nd mean

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