Question **1**

Not answered

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Let Y_n be a sequence of independent Poisson random variables with parameter $\lambda_n = 1/\sqrt{n}$ Study the convergence in quadratic mean of Y_n:

Select one:

a. $Y_n \xrightarrow{L_2} 1/\sqrt{n}$

b. $Y_n \xrightarrow{L_2} 1/n$

c. $Y_n \xrightarrow{L_2} 0$

d. $Y_n \xrightarrow{L_2} 1$

The correct answer is: $Y_n \xrightarrow{L_2} 0$

Question **2**

Not answered

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Let X_1 and X_2 be two random variables with distribution $X_1 \sim N(0, 2)$ and $X_2 \sim N(-2, 1)$ (parameters are mean and variance) and covariance -1. Compute $COV(X_1 + X_2, X_1 - X_2)$:

Select one:

a. 1

b. -2

c. -1

d. 2

The correct answer is: 1

Question **3**

Not answered

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Let X be a Bernoulli r.v. with parameter $\frac{1}{2}$.

Find the moment generating functions of $Y = \frac{1}{2} + \frac{X}{2}$

Select one:

- a. $M_Y(t) = \frac{1}{2}(1 + e^{\frac{t}{2}})$
- b. $M_Y(t) = \frac{1}{2}(e^t + e^{\frac{t}{2}})$
- c. $M_Y(t) = \frac{1}{2} + \frac{1}{2}(e^t + e^{-t})$
- d. $M_Y(t) = \frac{1}{2}(e^{\frac{3t}{2}})$

The correct answer is: $M_Y(t) = \frac{1}{2}(e^t + e^{\frac{t}{2}})$

Question **4**

Not answered

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Let X have the probability density function given by

$$f_X(x) = \frac{x}{2}$$

with $X \in [0, 2]$. Find the density function of $Y = 6X - 3$:

Select one:

- a. $f_Y(y) = \frac{3+y}{2}\frac{1}{6}$
- b. $f_Y(y) = \frac{3+y}{12}\frac{1}{6}$
- c. $f_Y(y) = \frac{3+y}{6}|\frac{1}{6}|$
- d. $f_Y(y) = \frac{3+y}{12}\frac{1}{3}$

The correct answer is: $f_Y(y) = \frac{3+y}{12}\frac{1}{6}$

Question **5**

Not answered

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Let θ be the parameter of a population random variable X that follows a continuous uniform distribution on the interval $[\theta-2, \theta+1]$, and let $X=(X_1,\ldots,X_n)$ be a simple random sample. Given the estimator $T(X)=\bar{X}+\frac{1}{2}$, decide if it is weakly consistent:

Select one:

- a. $T(X)$ is weakly consistent because $E[T(X)]=\theta$ and $Var[T(X)]=\frac{1}{n}$
- b. $T(X)$ is weakly consistent because $E[T(X)]=\theta$ and $Var[T(X)]=\frac{3}{4n}$
- c. $T(X)$ is not weakly consistent because its variance goes to infinity
- d. $T(X)$ is not weakly consistent because $E[T(X)]\neq\theta$

The correct answer is: $T(X)$ is weakly consistent because $E[T(X)]=\theta$ and $Var[T(X)]=\frac{3}{4n}$

Question **6**

Not answered

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A random variable X is supposed to follow a continuous distribution whose density function is

$$f(x;\theta)=\theta x^{\theta-1},$$

for $0<X<1$.

A sample of 4 observations, ($X_1=0.2$, $X_2=0.5$, $X_3=0.7$, $X_4=0.8$) is collected from X. Apply the method of the moments to find an estimate of the parameter θ:

Select one:

- a. $\hat{\theta}_M=1.22$
- b. $\hat{\theta}_M=0.55$
- c. $\hat{\theta}_M=2.5$
- d. $\hat{\theta}_M=0.667$

The correct answer is: $\hat{\theta}_M=1.22$

Question **7**

Not answered

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Let $\{Y_n\}$ be a sequence of independent Exponential random variables with parameter $\lambda_n = \frac{n}{2}$.

Find the value of n such that $Pr\{Y_n > 0.25\} \leq 0.80$:

Select one:

- a. $n = 15$
- b. $n = 10$
- c. $n = 8$
- d. $n = 5$

The correct answer is: $n = 10$

Question **8**

Not answered

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Let $X = (X_1, X_2)^\top$ be a random vector with joint density

$$f(x_1, x_2) = kx_2$$

where $0 < x_1 < x_2 < 1$.

Compute k:

Select one:

- a. $k = 2$
- b. $k = x_1$
- c. $k = \frac{1}{3}$
- d. $k = 3$

The correct answer is: $k = 3$

Question **9**

Not answered

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Indicate which of the following definitions is false. The convergence in mean of order 4 implies:

Select one:

- a. the convergence in quadratic mean
- b. the convergence in mean of order 3
- c. the almost sure convergence
- d. the convergence in distribution

The correct answer is: the almost sure convergence