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Courses » Introduction to Probability Theory and Stochastic Processes

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Unit 11 - Week 9

Course outline

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  - Motivation for Stochastic Processes
  - Definition of a Stochastic Process
  - Classification of Stochastic Processes

Assignment 9

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

Due on 2018-10-03, 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) Classify the following stochastic process based on the state space and index set. Number of vehicles in parking of a shopping mall at any time during the day. ***2 points***

- Discrete time discrete state stochastic process.
- Discrete time continuous state stochastic process.
- Continuous time discrete state stochastic process.
- Continuous time continuous state stochastic process.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Continuous time discrete state stochastic process.

2) Consider a simple symmetric random walk model. Let $X_1, X_2, \ldots$ be independent and identically distributed random variables with ***2 points***

$$P(X_1 = 1) = 0.5 \text{ and } P(X_1 = -1) = 0.5.$$

Define $S_n = \sum_{i=1}^{n} X_i,\ n \geq 1$.

Then, the value of probability $P(S_6 = 5 \mid S_1 = 1)$ is equal to

- $\frac{6}{2^6}$

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- Bernoulli Process
- Poisson Process
- Poisson Process (Continued)
- Simple Random Walk
- Time Series and Related Definitions
- Strict Sense Stationary Process
- Wide Sense Stationary Process and Examples
- Examples of Stationary Processes Continued
- Quiz : Assignment 9
- Assignment 9 Solutions

Week 10

Week 11

Week 12: Markovian Queueing Models

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No, the answer is incorrect.
Score: 0

Accepted Answers:
0

3) Consider a simple symmetric random walk model. Let $X_1, X_2, \ldots$ be independent and identically distributed random variables with ***2 points***

$$P(X_1 = 1) = 0.5 \text{ and } P(X_1 = -1) = 0.5.$$

Define $S_n = \sum_{i=1}^{n} X_i,\ n \geq 1$

The value of the probability $P(S_6 = 4 \mid S_1 = 1)$ is equal to

- $\frac{6}{2^6}$
- $\frac{6}{2^6}$
- 0
- $\frac{5}{2^5}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{5}{2^5}$

4) Let $\{N(t), t \geq 0\}$ be a Poisson process with rate 2. The value of ***2 points***

$$P(N(1.7) = 10, N(2.3) = 19, N(4.1) = 31)$$

is equal to

- $\frac{e^{-2*1.8}*(2*1.8)^{12}}{12!} * \frac{e^{-2*0.6}*(2*0.6)^9}{9!} \times \frac{e^{-2*1.7}*(2*1.7)^{10}}{10!}$
- $\frac{e^{-2*4.1}*(2*4.1)^{31}}{31!} * \frac{e^{-2*2.3}*(2*2.3)^{19}}{19!} \times \frac{e^{-2*1.7}*(2*1.7)^{10}}{10!}$
- $\frac{e^{-2*1.7}*(2*1.7)^{9}}{9!} * \frac{e^{-2*0.6}*(2*0.6)^{12}}{12!} \times \frac{e^{-2*1.8}*(2*1.8)^{31}}{31!}$
- $\frac{e^{-2*2.3}*(2*2.3)^{19}}{19!} * \frac{e^{-2*0.6}*(2*0.6)^9}{9!} \times \frac{e^{-2*1.8}*(2*1.8)^{12}}{12!}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{e^{-2*1.8}*(2*1.8)^{12}}{12!} * \frac{e^{-2*0.6}*(2*0.6)^9}{9!} \times \frac{e^{-2*1.7}*(2*1.7)^{10}}{10!}$

5) Let Z_1 and Z_2 be two independent normally distributed random variables, each having mean 0 and variance σ^2. Let $\lambda \in \mathbb{R}$. Let ***2 points***

$$X_t = Z_1 \cos \lambda t + Z_2 \sin \lambda t,\ t \geq 0$$

Which of the following is not TRUE?

$\{X(t), t \geq 0\}$ is a second order process.

$E(X(t)) = 0$

$E(X(t)^2) = 1$

$\{X(t), t \geq 0\}$ is a wide sense stationary process

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E(X(t)^2) = 1$

6) In a communication system, a carrier signal at a receiver is modeled as a stochastic process *2 points*

$$\{X(t) = cos(2\pi ft + \theta); t \geq 0\}$$

where $\theta \sim U[-\pi, \pi]$ and f is a constant. Then, which of the following is/are TRUE?

$\{X(t), t \geq 0\}$ is a second order process

$E(X(t)) = 0$

$Cov(X(t), X(s))$ is a function of $|t - s|$

$\{X(t), t \geq 0\}$ is a wide sense stationary process

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\{X(t), t \geq 0\}$ *is a second order process*
$E(X(t)) = 0$
$Cov(X(t), X(s))$ *is a function of* $|t - s|$
$\{X(t), t \geq 0\}$ *is a wide sense stationary process*

7) Let $\{X(t), t \geq 0\}$ be a strict sense stationary stochastic process. Let A be a positive random variable independent of the stochastic process $\{X(t), t \geq 0\}$. Define *2 points*

$$Y(t) = AX(t),\ t \geq 0$$

Then, which of the following is/are TRUE?

$\{Y(t), t \geq 0\}$ is always a strict sense stationary process.

$\{Y(t), t \geq 0\}$ is never a strict sense stationary process.

$\{Y(t), t \geq 0\}$ may or may not be a strict sense stationary process.

$\{Y(t), t \geq 0\}$ is not even a stochastic process.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\{Y(t), t \geq 0\}$ is always a strict sense stationary process.

8) Let X_n be an i.i.d. sequence of Gaussian random variables with zero mean and variance σ^2 and let Y_n be ***2 points***

$Y_n = \frac{X_n + X_{n-1}}{2}$

Which of the following is/are not TRUE?

- $E(Y_n) = 0$
- Y_n is second order process
- Covariance of Y_n and Y_{n+1}, is zero.
- $E(Y_n)$ is not constant

No, the answer is incorrect.
Score: 0

Accepted Answers:
Covariance of Y_n and Y_{n+1}, is zero.
$E(Y_n)$ is not constant

9) ***2 points***
Classify the following stochastic process based on the state space and index set. The number of particles emitted by a certain radioactive material undergoing radioactive decay during a certain period.

- Discrete time discrete state stochastic process.
- Discrete time continuous state stochastic process.
- Continuous time discrete state stochastic process.
- Continuous time continuous state stochastic process.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Continuous time discrete state stochastic process.

10) Let $\{X_1(t), t \geq 0\}$ and $\{X_2(t), t \geq 0\}$ are independent wide sense stationary processes with expected values μ_1 and μ_2 and autocorrelation functions $R_1(h)$ and $R_2(h)$ respectively. Which of the following is/are TRUE? ***2 points***

- $E(X_1(t)X_2(t)) = \mu_1\mu_2$
- $X_1(t)X_2(t)$ is a wide sense stationary process
- Auto covariance function of $X_1(t)X_2(t)$ is $R_1(h)R_2(h)$
- $E(X_1(t)X_2(t)) = \mu_1 + \mu_2$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$E(X_1(t)X_2(t)) = \mu_1\mu_2$

$X_1(t)X_2(t)$ *is a wide sense stationary process*

Auto covariance function of $X_1(t)X_2(t)$ is $R_1(h)R_2(h)$

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