Unit 14 - week 12

Assignment 12

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

Due on 2019-10-23, 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 questions. In case of multiple answers partial marks will be awarded for every correct option chosen provided no incorrect option have been chosen. 0 marks are awarded for questions not attempted.

1) Let $\{X(t), t \geq 0\}$ be a stochastic process. Which of the following is always TRUE? ***2 points***

- If $\{X(t), t \geq 0\}$ is a second-order process then it must be a wide-sense stationary process.
- If $\{X(t), t \geq 0\}$ is a wide sense stationary process then it must be a second order process.
- If $\{X(t), t \geq 0\}$ is a second order process with constant mean then it must be a wide-sense stationary process.
- $\{X(t), t \geq 0\}$ always has independent increments.

No, the answer is incorrect.
Score: 0

Accepted Answers:
If $\{X(t), t \geq 0\}$ is a wide sense stationary process then it must be a second order process.

2) The first generation of particles is the collection of offsprings of a given particle. The next generation is formed by the offsprings of these members. ***2 points***
If the probability that a particle has k offsprings is p_k, where $p_0 = \frac{1}{4}, p_1 = \frac{1}{2}, p_2 = \frac{1}{4}$. Assume that particles act independently and identically irrespectively of the generation. The probability of ultimate extinction equals

- $\frac{1}{5}$
- $\frac{3}{5}$
- $\frac{2}{5}$
- 1

No, the answer is incorrect.
Score: 0

Accepted Answers:
1

3) Consider a branching process $\{Z_n, n = 0, 1, 2, \ldots\}$ with $Z_0 = 1$ (starting with single individual). Let the family size distribution Y be be a discrete ***2 points*** uniform random variable taking mass at $\{0, 1, 2\}$. The variance of Z_{11} i.e., the population at generation 11, is

- 11
- $\frac{22}{3}$
- $\frac{2}{3}$
- 1

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{22}{3}$

4) Consider a branching process $\{Z_n, n = 0, 1, 2, \ldots\}$ with $Z_0 = 1$(starting with single individual). Let the family size distribution Y be a discrete ***2 points*** uniform random variable taking mass at $\{0, 1, 2\}$. The probability that there is no particle in Z_3 i.e., extinction occurs at the the third generation provided extinction doesn't occur at second generation is

- $\frac{196}{2187}$
- $\frac{196}{2178}$
- $\frac{169}{2187}$
- $\frac{169}{2178}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{196}{2187}$

5) ***2 points***
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
$Y(t) = AX(t)$
Then, which of the following is 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.

6) In a communication system, the carrier signal at the receiver is modeled by $Y(t) = X(t)cos(2\pi\omega t + \Theta)$ where ***2 points***
$\{X(t), t \geq 0\}$ is a zero mean wide-sense stationary process and Θ is a uniformly distributed random variable in interval $(-\pi, \pi)$ and ω is a constant. Assume that Θ is independent of the process $\{X(t), t \geq 0\}$. Then, which of the following is not TRUE?

- Mean function of $\{Y(t), t \geq 0\}$ is independent of t.
- $E(Y(t)^2)$ is finite.
- Covariance function of $\{Y(t), t \geq 0\}$ is $0.5\cos(2\pi\omega(t-s))Cov(X(t), X(s))$
- $\{Y(t), t \geq 0\}$ is not a wide-sense stationary process.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\{Y(t), t \geq 0\}$ is not a wide-sense stationary process.

7) Let $\{X(t), t \geq 0\}$ be a stochastic process with independent increments. Then, which of the following is always TRUE? ***2 points***

- $\{X(t), t \geq 0\}$ is a Markov process.
- $\{X(t), t \geq 0\}$ need not be a Markov process.
- $\{X(t), t \geq 0\}$ is a wide-sense stationary stochastic process.
- $\{X(t), t \geq 0\}$ is a strict-sense stationary process.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\{X(t), t \geq 0\}$ is a Markov process.

8) Let $\{N(t), t \geq 0\}$ be a Poison process with parameter λ. Then, which of the following is not TRUE? ***2 points***

- $\{N(t), t \geq 0\}$ is a Markov process.
- $\{N(t), t \geq 0\}$ is a wide-sense stationary process.
- $\{N(t), t \geq 0\}$ has independent increments.
- $E(N(t)^2) < \infty$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\{N(t), t \geq 0\}$ is a wide-sense stationary process.