1. Which of the following best describes a stochastic process?

a) A predictable sequence of events
b) A random process involving the evolution of a system over time
c) A deterministic outcome with no variability
d) A stationary sequence of events

Answer: b) A random process involving the evolution of a system over time

Explanation: A stochastic process is a mathematical model used to describe the evolution of a system over time in a random or probabilistic manner.

2. What distinguishes deterministic processes from nondeterministic processes?

a) Deterministic processes are predictable, while nondeterministic processes are random
b) Deterministic processes have random outcomes, while nondeterministic processes are predictable
c) Deterministic processes have no variability, while nondeterministic processes are unpredictable
d) Deterministic processes exhibit randomness, while nondeterministic processes follow a specific pattern

Answer: a) Deterministic processes are predictable, while nondeterministic processes are random

Explanation: Deterministic processes have outcomes that are entirely determined by the initial conditions, whereas nondeterministic processes involve randomness or uncertainty.

3. Which concept refers to the stability of statistical properties over time?

a) Determinism
b) Ergodicity
c) Stationarity
d) Independence

Answer: c) Stationarity

Explanation: Stationarity refers to the statistical properties of a stochastic process remaining constant over time, such as mean, variance, and autocorrelation.

4. A first-order stationary process exhibits constancy in which statistical property?

a) Mean
b) Variance
c) Autocorrelation
d) Independence

Answer: a) Mean

Explanation: A first-order stationary process maintains constant mean over time, while other statistical properties may vary.

5. Second-order stationarity implies constancy in which statistical properties?

a) Mean and variance
b) Mean and autocorrelation

c) Variance and autocorrelation
d) Mean, variance, and autocorrelation

Answer: d) Mean, variance, and autocorrelation

Explanation: Second-order stationarity maintains constancy in mean, variance, and autocorrelation over time.

6. What characterizes a Gaussian random process?

a) It follows a Poisson distribution
b) Its probability density function is Gaussian
c) It exhibits a linear response
d) It is deterministic

Answer: b) Its probability density function is Gaussian

Explanation: A Gaussian random process has a probability density function (PDF) that follows a Gaussian (normal) distribution.

7. The autocorrelation function measures:

a) The correlation between two random variables
b) The correlation between a signal and a delayed version of itself
c) The covariance between two random variables
d) The covariance between a signal and a delayed version of itself

Answer: d) The covariance between a signal and a delayed version of itself

Explanation: The autocorrelation function measures the similarity between a signal and a delayed version of itself at different time lags.

8. What does the term “ergodicity” imply in stochastic processes?

a) The process has a linear response
b) Statistical properties can be inferred from a single realization
c) The process exhibits complete randomness
d) The process is deterministic

Answer: b) Statistical properties can be inferred from a single realization

Explanation: Ergodicity refers to the property where the statistical properties of a process can be determined from a single sample path or realization.

9. Which type of process is characterized by independence between successive values?

a) Stationary process
b) Gaussian process
c) Poisson process
d) Markov process

Answer: d) Markov process

Explanation: In a Markov process, future states depend only on the current state and are independent of the past states.

10. What is the primary difference between mean-ergodic processes and correlation-ergodic

processes?

a) Mean-ergodic processes have constant mean values, while correlation-ergodic processes have constant autocorrelation values.
b) Mean-ergodic processes have constant autocorrelation values, while correlation-ergodic processes have constant mean values.
c) Mean-ergodic processes exhibit constancy in mean values across time, while correlation-ergodic processes exhibit constancy in autocorrelation values.
d) Mean-ergodic processes exhibit constancy in autocorrelation values across time, while correlation-ergodic processes exhibit constancy in mean values.

Answer: c) Mean-ergodic processes exhibit constancy in mean values across time, while correlation-ergodic processes exhibit constancy in autocorrelation values.

Explanation: Mean-ergodic processes maintain constant mean values over time, while correlation-ergodic processes maintain constant autocorrelation values over time.

11. Which property distinguishes wide-sense stationary processes from strict-sense stationary processes?

a) Wide-sense stationary processes have a constant mean, while strict-sense stationary processes have a variable mean.
b) Wide-sense stationary processes have constant autocorrelation for all lags, while strict-sense stationary processes have constant autocovariance for all lags.
c) Wide-sense stationary processes have finite variance, while strict-sense stationary processes have infinite variance.
d) Wide-sense stationary processes have constant autocovariance for all lags, while strict-

sense stationary processes have constant autocorrelation for all lags.

Answer: b) Wide-sense stationary processes have constant autocorrelation for all lags, while strict-sense stationary processes have constant autocovariance for all lags.

Explanation: Wide-sense stationary processes have constant autocorrelation, whereas strict-sense stationary processes have constant autocovariance.

12. Which property is not necessarily a requirement for a stochastic process to be considered stationary?

a) Constant mean
b) Constant variance
c) Constant autocorrelation
d) Constant autocovariance

Answer: d) Constant autocovariance

Explanation: While constant autocovariance is a characteristic of strict-sense stationary processes, it is not necessarily a requirement for a process to be considered stationary.

13. What is the primary difference between a Poisson random process and a Gaussian random process?

a) Poisson processes exhibit discrete events, while Gaussian processes exhibit continuous outcomes.
b) Poisson processes have constant mean values, while Gaussian processes have constant autocorrelation values.

c) Poisson processes follow a normal distribution, while Gaussian processes follow a Poisson distribution.
d) Poisson processes exhibit linear responses, while Gaussian processes exhibit nonlinear responses.

Answer: a) Poisson processes exhibit discrete events, while Gaussian processes exhibit continuous outcomes.

Explanation: Poisson processes model the occurrence of discrete events over time, while Gaussian processes represent continuous outcomes following a normal distribution.

14. What does the cross-correlation function measure in stochastic processes?

a) The correlation between two distinct stochastic processes
b) The correlation between two random variables
c) The covariance between two stochastic processes
d) The covariance between a stochastic process and its delayed version

Answer: c) The covariance between two stochastic processes

Explanation: The cross-correlation function measures the covariance between two stochastic processes at different time lags.

15. In a wide-sense stationary process, the autocorrelation function depends only on:

a) The current value of the process
b) The previous value of the process
c) The difference between two time points

d) The sum of two time points

Answer: c) The difference between two time points

Explanation: In wide-sense stationary processes, the autocorrelation function depends only on the time difference between two time points, not on the absolute time values.

16. Which type of process is characterized by the occurrence of random events at a constant rate over time?

a) Gaussian process
b) Poisson process
c) Markov process
d) Wiener process

Answer: b) Poisson process

Explanation: A Poisson process models the occurrence of random events at a constant rate over time.

17. What is the primary purpose of the covariance function in stochastic processes?

a) To measure the similarity between two random variables
b) To measure the spread of a random variable
c) To measure the linear relationship between two stochastic processes
d) To measure the variability of a stochastic process

Answer: c) To measure the linear relationship between two stochastic processes

Explanation: The covariance function quantifies the linear relationship between two stochastic processes.

18. Which type of stationarity implies that all statistical moments remain constant over time?

a) First-order stationarity
b) Second-order stationarity
c) Wide-sense stationarity
d) Strict-sense stationarity

Answer: d) Strict-sense stationarity

Explanation: Strict-sense stationarity maintains constancy in all statistical moments (mean, variance, higher-order moments) over time.

19. Which property of a stochastic process allows statistical properties to be estimated from a single realization?

a) Independence
b) Ergodicity
c) Stationarity
d) Determinism

Answer: b) Ergodicity

Explanation: Ergodicity allows statistical properties of a stochastic process to be inferred from a single sample path or realization.

20. What does the autocorrelation function represent in stochastic processes?

a) The correlation between two distinct stochastic processes
b) The correlation between a stochastic process and its delayed version
c) The covariance between two random variables
d) The variance of a stochastic process

Answer: b) The correlation between a stochastic process and its delayed version

Explanation: The autocorrelation function measures the similarity between a stochastic process and a delayed version of itself at different time lags.