Discrete and Continuous Stochastic Processes

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Overview

1. Overview of Discrete and Continuous Stochastic Processes

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- **Definition** Let T be a subset of $[0, \infty)$. A family of random variables $\{X_t\}, t \in T$, indexed by T, is called a stochastic (or random) process. When $T = N$ (or $T = N_0$), $\{X_t\}, t \in T$ is said to be a discrete-time process, and when $[0, \infty)$, it is called a continuous-time process.

- When $T = [0, \infty)$ (continuous-time processes), the value of the process can change every instant. When $T = N$ (discrete-time processes), the changes occur discretely.

- Stochastic processes are very important both in mathematical theory and its applications in science, engineering, economics, etc. i.e Situations where the quantity of interest varies through time.

- Every stochastic process can be viewed as a function of two variables t and ω. For each fixed $t, \omega \mapsto X_t(\omega)$ is a random variable, as postulated in the definition. However, if we change our point of view and keep ω fixed, we see that the stochastic process is a function mapping ω to the real-valued function $\omega \mapsto X_t(\omega)$.

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