

# Discrete and Continuous Stochastic Processes

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## 1 Overview of Discrete and Continuous Stochastic Processes

# Overview of Discrete and Continuous Stochastic Processes

- **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  $\omega$ . 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  $\omega$  fixed, we see that the stochastic process is a function mapping  $\omega$  to the real-valued function  $\omega \mapsto X_t(\omega)$ .

# The End