Faculty of Engineering

EM 509 – Stochastic Processes

Answer Sheet

Introduction

1) Snakes and ladders board game

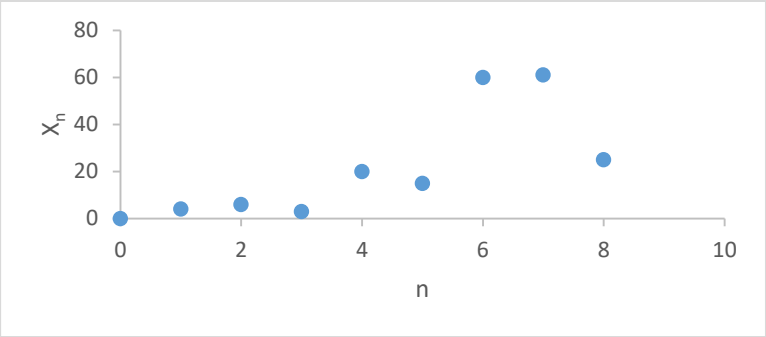
State space: The position of the player in the 100 board after particular move

$$S = \{1, 2, ..., 100\}$$

Index set: The number of time that the dice was rolled

$$n = \{0,1,2,....\}$$

This is a discrete time stochastic process with discrete state space. Then some realizations are 0,4,6,3,20,15,60,61,25,... and 1,58,63,12,0,40,…



2) The number of telephone calls arriving at an automatic phone-switching system.

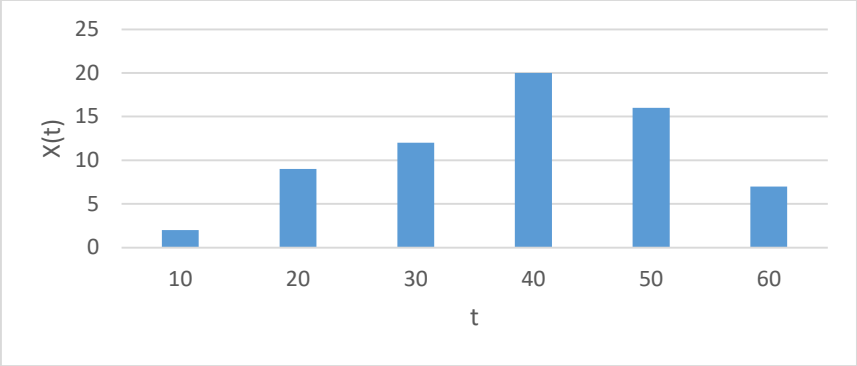
State space: The number of telephone calls

$$S = \{1, 2, 3, ...\}$$

Index set: An interval of real line

$$n = \{\text{time} t \geq 0\}$$

This is a continuous time stochastic process with discrete state space. Then the realization is $\{X(t); t \geq 0\}$.



3) Number of customers in the time interval

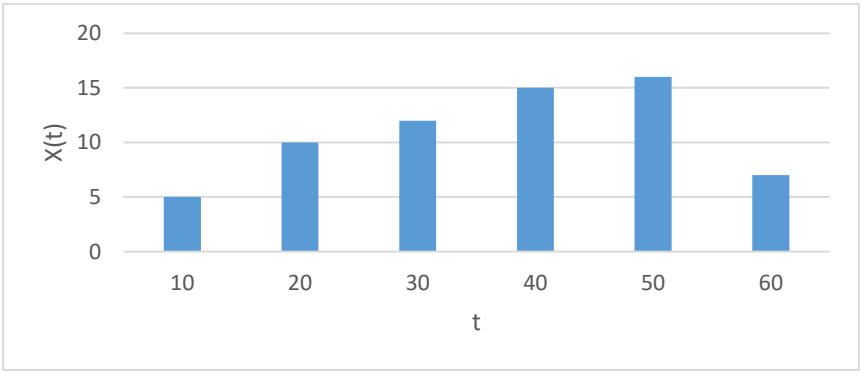
State space: The number of customers

$$S = \{1, 2, 3, ...\}$$

Index set: An interval of real line

$$n = \{\text{time} t \geq 0\}$$

This is a continuous time stochastic process with discrete state space. Then the realization is $\{X(t); t \geq 0\}$.



4) The n-th bit in the binary expansion of a number in [0,1)

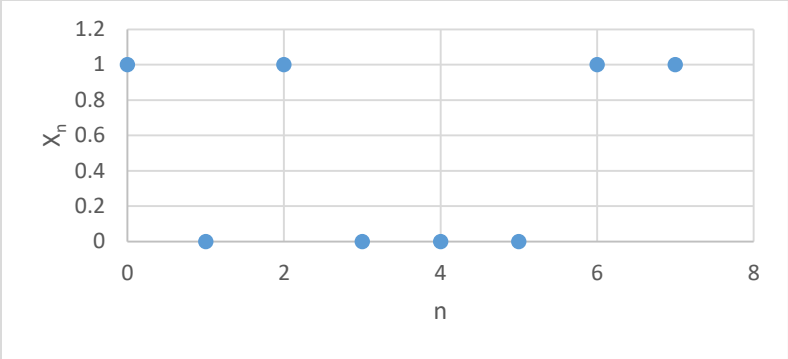
State space: the n-th bit in the binary expansion of a number in [0,1)

$$S = \{0,1\}$$

Index set: the position of bit

$$n = \{0,1,2,3,....\}$$

This is a discrete time stochastic process with discrete state space. Then the realizations are 1,0,1,0,0,0,1,1,… and 0,1,1,1,1,0,0,…



5) Digital Modulation: Phase-Shift Keying

State space: The phrase of the transmitted signal

$$S = \left\{-\frac{\pi}{2}, \frac{\pi}{2}\right\}$$

Index set: An interval of real line

$$n = \{\text{time} t \geq 0\}$$

This is a continuous time stochastic process with discrete state space. Then the realization is $\frac{\pi}{2}, \frac{\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, -\frac{\pi}{2}, \ldots$