

02/09/2026: Markov Chains (Part 1)

CSCI 546: Diffusion Models

Textbook reference: Sec 6.1-6.2

Announcement (Sign-in Sheet)

Please sign the sign-in sheet.

Review Problem Set #7

Concepts for Problem Set #8

Simple random walk

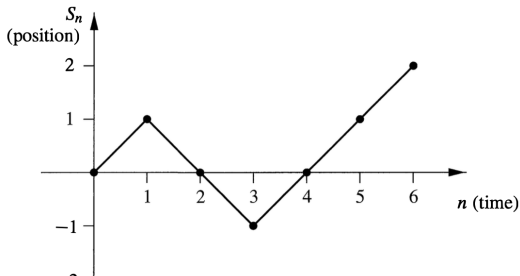
For timesteps $n = 1, 2, 3, \dots$, let

$$X_n = \begin{cases} 1, & \text{with probability } p \\ -1, & \text{with probability } q = 1 - p \end{cases}$$

Then a **simple random walk** (in one dimension) is given by

$$S_n = S_0 + \sum_{i=1}^n X_i,$$

where S_0 is the starting position.



Random Groups

Aubrey Williams: 6

Austin Barton : 6

Blake Sigmundstad: 3

Diego Moylan: 2

Dillon Shaffer: 1

Ismoiljon Muzaffarov: 7

Jacob Tanner: 3

Josh Stoneback: 3

Joshua Bowen: 1

Joshua Culwell: 5

Laura Banaszewski: 5

Lina Hammel: 4

Logan Racz: 1

Matt Hall: 4

Micah Miller: 8

Mike Kadoshnikov: 8

Owen Cool: 2

Racquel Bowen: 2

Samuel Mocabee: 4

Tatiana Kirillova: 7

Group exercises - Problem Set 8

1. (6.1.2) A die is rolled repeatedly. Which of the following are Markov chains? For those that are, supply the transition matrix
 - (a) The largest number X_n shown up to the n -th roll.
 - (b) The number N_n of sixes in n rolls.
 - (c) At time r , the time C_r since the most recent six.
 - (d) At time r , the time B_r until the next six.
2. (Sec 6.2) Show that a simple random walk is periodic with period 2. Then show that a simple random walk is recurrent if $p = \frac{1}{2}$ but transient if $p \neq \frac{1}{2}$.