(CS 5008) Reinforcement Learning : Assignment 3

Markov Chain

Q1) Consider a random walk on the set of integer $\mathbb{Z}$ described as follow: $Prob(s_{t+1} = s+1|s_t = s) = 0.5$ and $Prob(s_{t+1} = s-1|s_t = s) = 0.5$. Start from various initial distributions μ_0 (remember $s_0 \sim \mu_0$), and find out μ_4, the distribution after 4 time steps.

Q2) Consider a single queue with maximum length $n = 9$. What is the total number of states? Let the queue evolve in discrete time steps $t = 0, 1, \ldots$, and let probability of arrival of a customer between times t and $t+1$ be p, and let the probability that a customer is serviced between t and $t+1$ be q. Also, let arrival and service be independent of each other. Describe the probability transition matrix for this system.

Q3) We know that $\mu_{t+1}^{\top} = \mu_t \mathcal{P}$. Verify that μ_{t+1} is a distribution if μ_t is a distribution.

Q4) Consider the filtering problem discussed in the class? Verify that $Prob(s_0|o_0, s_0 \sim \mu_0)$ is nothing but the Bayes rule.

Q5) Consider the filtering problem discussed in the class? How will we find $Prob(s_t|o_k, s_0 \sim \mu_0)$, where $k < t$.

Q6) Please work out the “rain and umbrella" explained in class for i) Filtering ii) Prediction iii) Smoothing and iv) Maximum likelihood sequence (Viterbi Algorithm). Play around with different numbers.