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TOPIC:

CTMC

a. Take input as the TPM and the rates

b. Find Steady State Behavior by solving equations. and simulating it for multiple runs

c. Find the state probability at given time "t" . Output that as equation (as theoretical value) and also run it multiple times to see if this number approximates

CTMC

A continuous-time Markov chain (CTMC) is a continuous stochastic process in which, for each state, the process will change state according to an exponential random variable and then move to a different state as specified by the probabilities of a stochastic matrix. An equivalent formulation describes the process as changing state according to the least value of a set of exponential random variables, one for each possible state it can move to, with the parameters determined by the current state

A stochastic process {X(t) : t ≥ 0} with discrete state space S is called a continuous-time Markvov chain (CTMC) if for all t ≥ 0, s ≥ 0, i ∈ S, j ∈ S,

$$P(X(s + t) = j|X(s) = i, \{X(u) : 0 \leq u < s\}) = P(X(s + t) = j|X(s) = i) = Pij\ (t).$$

A CTMC makes transitions from state to state, independent of the past, according to a discrete-time Markov chain, but once entering a state remains in that state, independent of the past, for an exponentially distributed amount of time before changing state again.

Example:

Jesse is a newborn baby who is always in one of three states: eat, play, and sleep. He eats on average for 30 minutes at a time; plays on average for 1 hour; and sleeps for about 3 hours. After eating, there is a 50-50 chance he will sleep or play. After playing, there is a 50-50 chance he will eat or sleep. And after sleeping, he always plays. Jesse's life is governed by a continuous-time Markov chain.