

Lehrstuhl für Simulation

Applied Discrete Modelling

Assignment 2 “Diagnosis”: CTMCs

System Specification

A specific disease can progress in up to three stages towards healing. We assume for this model, that one step is equivalent to one day. The average duration of the disease is 10 days. The average time spent in stage 1 is 3 days. The average time spent in stage 2 is 7 days.

At the beginning of the simulation the patient has the disease in stage 1. We assume daily temperature measurements and the following probabilities for fever: in stage 1 $P(\text{fever}) = 0.1$, in stage 2 $P(\text{fever}) = 0.5$, in stage 3 $P(\text{fever}) = 0.8$.

Implementation

Extend your DTMC solution program to discretize any CTMC using a given time step. The program should import CTMC specifications in the format given in the exercise.

Tasks and Questions

Specify and draw the CTMC representing the system.

Use your program to answer the following questions:

- What is the probability that the patient is still sick after 8 days for different discretization time steps (e.g. 2, 1, 0.5, 0.25, 0.1)?
- What is the probability of measuring fever on the 9th day for different discretization time steps (e.g. 2, 1, 0.5, 0.25, 0.1)?
- What is the expected duration until healing with probability 99% for different discretization time steps (e.g. 2, 1, 0.5, 0.25, 0.1)?