

Lehrstuhl für Simulation

Applied Discrete Modelling

Assignment 1 “Diagnosis”: DTMCs

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 probability of healing after one day is 0.1, independent of the current disease state. The one step probability of progressing from stage 1 to stage 2 is 0.3. The probability to progress from stage 2 to stage 3 is 0.15. 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

Construct a general DTMC solution program in a programming language of your choice. The program should compute steady state and transient solutions and import DTMC specifications in the format given in the exercise.

Tasks and Questions

Specify and draw the DTMC representing the system.

Use your program to answer the following questions:

- What is probability that the patient is still in stage 1 after 8 days?
- What is the total probability to be sick after 8 days?
- What is the probability of detecting fever on the next day?
- Does this model have limiting or stationary solutions? Why?
- How long does the system need to reach a stationary solution?
- When will the patient be healed with a probability of 99%?