

1 Device Reliability

Imagine a system comprised initially of 3 identical devices that are in operation, and 2 spares. Each device in operation has a probability $p_F=0.01$ of failing in one time-step. If a device fails it may be repaired immediately, if there is an available spare. The system fails when all of the devices have failed and there are no remaining spares.

Model this system with a DTMC and generate a plot of the CDF of the time-step at which the system fails.

2 Sidewalk Survivability

A drunkard wakes up on the sidewalk of a city, where the sidewalk is made up of concrete slabs. Slabs can be numbered, with 1 being the eastmost, 2 being the slab adjacent to 1 on the west, and so on. The sidewalk on the block has n slabs. The drunkard staggers around. The street is tilted slightly with the east being lower than the west, and with each crossing from one slab to the next there is a 0.6 chance of him staggering to the east and a 0.4 chance of him staggering to the west. If he reaches slab 1 and with the next step staggers east he falls into the street and gets hit by a truck. If he reaches slab n and with the next step staggers west he falls into the street and gets hit by a bus.

Create a DTMC description of this process, and write program that analyzes the DTMC to determine (a) the chance he eventually falls into the east street, and (b) the chance he eventually falls into the west street. Create a plot that gives these probabilities as a function of the drunkard's starting position.