**MCP261 IE Lab I: Exercise 7 February 25, 2020**

**Exercise 7: Discrete Event Simulation III**

For all questions below, use a random number seed of 1234.

Information for questions below: you will use the discrete-event simulation package SimPy for conducting some basic discrete event simulations in the next couple of exercises. Documentation for SimPy can be found here: <https://simpy.readthedocs.io/en/latest/simpy_intro/index.html>

1. (5 marks) Create a simulation of a doctor serving patients. Let patients arrive according to the exponential distribution, with a mean interarrival time of 5 minutes. Let the doctor’s service time follow a Gaussian distribution with mean 4 minutes and standard deviation 2 minutes. Run the simulation until simulation time = 40000 minutes, and assume a warm-up period of 5000 minutes (outputs to be recorded only after warm-up period has elapsed). Generate a histogram of the average waiting times of the patients, and find the best-fit distribution (among the Gaussian, triangular, beta, gamma and exponential) for average waiting time with its parameters. Estimate the utilization of the doctor as well (time spent serving patients divided by total time available).
2. (5 marks) Create a simulation of a clinic with 2 doctors serving 2 types of patients (inpatients and outpatients). Both doctors are available for the entire duration of the simulation, and can serve both types of patients (i.e., think of them as parallel identical machines in a workstation). Outpatients and inpatients both arrive according to the exponential distribution, with mean interarrival times of 5 and 120 minutes, respectively. Let the doctor’s service times follow Gaussian distributions with mean 4 minutes and standard deviation 2 minutes for outpatients and a mean of 30 minutes and SD of 8 minutes for inpatients. Run the simulation until simulation time = 50000 minutes, and assume a warm-up period of 5000 minutes (outputs to be recorded only after warm-up period has elapsed). Generate histograms of the average waiting times of both types of patients, and find the best-fit distributions (among the Gaussian, triangular, beta, gamma and exponential) for average waiting times with their parameters. Estimate the utilization of the doctor as well (time spent serving patients divided by total time available).