**MCP261 IE Lab I: Exercise 6 February 18, 2020**

**Exercise 6: Discrete Event Simulation II**

Download the TTF simulation code from [here](http://users.iems.northwestern.edu/~nelsonb/IEMS435/). For all questions below, use a random number seed of 1234.

Information for questions 1 and 2: consider a system with two machines – one is an active machine and the other is an inactive spare. The spare machine becomes active when the (currently) active machine fails, while the failed machine immediately starts repair. The failed machine becomes the spare when its repair is completed. Only one component at a time can be repaired, so the system as a whole fails if both components have failed, and it is operational as long as at least one of the components is working.

The time to failure of a machine can with equal probability be 2, 4, 6, 8 or 10 days, while repair takes exactly 3.5 days. A repaired machine is as good as new.

1. (5 marks) Modify the TTF simulation such that it works with any number of machines (integer > 1). Find the average time to failure with 5 machines (100 replications).
2. (2 marks) Modify the system in Problem 1 such that time to repair is 3.5 days with probability 0.4 and 2.5 days otherwise. Find the average time to failure by programming 100 replications.

Information for question 3: 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>

Download and install SimPy before starting to read the introduction. Go through the “SimPy in 10 Minutes” before starting this question. Note that some background on object oriented programming may be required to fully appreciate the material (for this, use the Think Python book).

1. (5 marks) Recreate the car parking and driving process (given here: <https://simpy.readthedocs.io/en/latest/simpy_intro/basic_concepts.html>) assuming parking duration follows a normal distribution with mean 20 and SD 1 minute, and driving duration follows an exponential distribution with mean 30 minutes. Run the simulation until 1000 time units have elapsed.