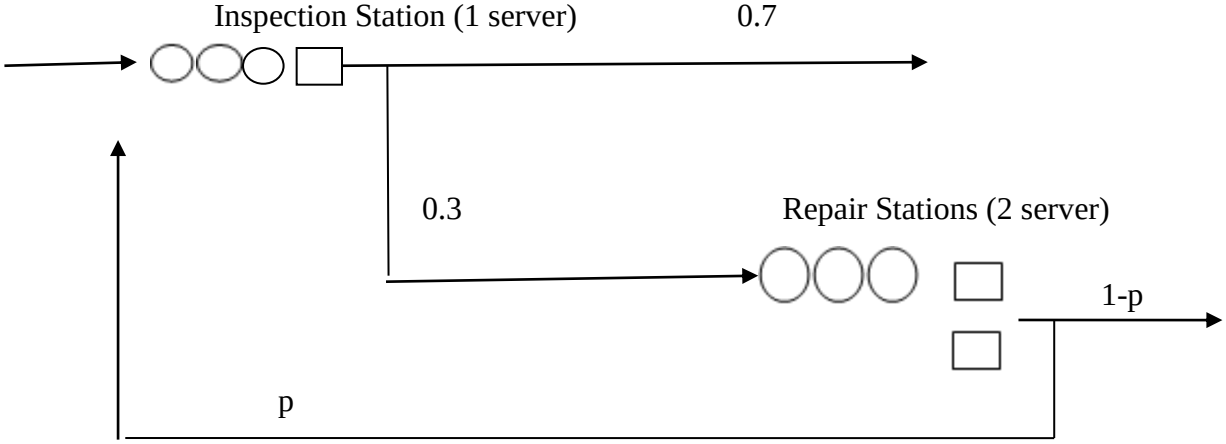
Computer Simulations
Homework 1

Spring 2021

1. Problem 1.30 of the text book, with the following additional conditions

(i) A repaired bus needs to be re-inspected with probability p.

(ii) The probability of passing the inspection for any bus is 0.7.



Homework requirements:

(i) Set the re-inspection probability p according to the last digit of your student ID, divided by 10, plus 0.1 .i.e. If the last digit of your student ID is 8, then probability p is 0.8+0.1 = 0.9.

(ii) Calculate the average no. of the buses successfully passing the inspection per hour before the simulation, assuming the external bus arrival rate is λ(/hour).

(iii) Obtain the utilization of the Inspection station and each Repair Shop via simulation for different bus arrival rates (such as λ=0.2, 0.4, 0.6…3.0/hr) for 160 hours. Make sure that the system is maintained to be in a stable status.

(iv) Estimate the maximum capacity of the whole bus inspection depot with the selected p, after running the simulation for very long time.

Need to upload your source code to NTU ceiba web site, hardcopy of answers/simulation results should be submitted in the class on Mar 31, 2021. (delayed submission of this homework is allowed, but there will be discounted credit)

1.30. City busses arrive to the maintenance facility with exponential interarrival times with mean 2 hours. The facility consists of a single inspection station and two identical repair stations; see Fig. 1.55. Every bus is inspected, and inspection times are distributed uniformly between 15 minutes and 1.05 hours; the inspection station is fed by a single FIFO queue. Historically, 30 percent of the busses have been found during inspection to need some repair. The two parallel repair stations are fed by a single FIFO queue, and repairs are distributed uniformly between 2.1 hours and 4.5 hours. Run the simulation for 160 hours and compute the average delay in each queue, the average length of each queue, the utilization of the inspection station, and the utilization of the repair station (defined to be half of the time-average number of busy repair stations, since there are two stations). Replicate the simulation 5 times. Suppose that the arrival rate of busses quadrupled, i.e., the mean interarrival time decreased to 30 minutes. Would the facility be able to handle it? Can you answer this question without simulation?