

## Homework 1

1. Suppose that we have a tandem queueing system with two stations. Station 1 has two identical servers with service-time distribution being  $Exp(1)$ , and Station 2 has only one server with service-time distribution being  $Exp(2)$ . The arrival to the system follows a Poisson process with rate  $\lambda$ . Assume that the system follows the first-come first-serve queueing rule.
  - (a) Write a discrete-event simulation algorithm/pseudocode to simulate the system, and code the algorithm in either Python or Matlab.
  - (b) Set  $\lambda = 1.8$ . Collect 1000 observations of the customer sojourn time after a warm-up period of 3000 time units. Plot the histogram of the sojourn time, calculate the average sojourn time and compare it to the Jackson network formula.
  - (c) Change the service-time distribution of Station 2 to a normal distribution with  $\mu = 0.5$  and  $\sigma = 0.15$  (ignore negative service times if encountered). Repeat the task in (b).
  - (d) Plot the average sojourn time against  $\lambda$  with  $0 < \lambda < 2$  for the service-time distribution in (c).