

Homework 6

You should describe any programs, spreadsheets or formulae used through program listings and sample output, or by printing out formulae in any spreadsheets.

On-campus students should drop their homework assignments in the box located on the second floor of Rhodes Hall. You may work with a partner and hand in a single homework with both your names and net IDs on it.

Off-campus students should use the electronic drop box to hand in a document named LastName_NetId_HomeworkNo. If you work in a pair then you should *each* hand in a copy of the homework with the file name YourLastName_YourNetId_OtherLastName_OtherNetId_HomeworkNo, and ensure that the names and netIDs of both students appear at the top of the file you hand in.

1. (a) (80 pts) Write a computer program that simulates the Big Red Bikes system, now assuming that each station has a capacity of 20, and station 1, 2, 3 starts with 7, 18, and 15 bikes at the beginning of every day, respectively (never mind how that's achieved). Students arrive to station 1, 2, 3 with exponential interarrival times with mean 8, 7, 6 minutes, respectively. The probabilities that they will ride from a station (in rows) to another (in columns) are given in the table below (e.g. A rider starting at Station 1 will go to Station 2 with probability 0.4).

From To	Station 1	Station 2	Station 3
Station 1	0	0.4	0.6
Station 2	0.4	0	0.6
Station 3	0.6	0.4	0

The riding time in minutes between any two stations is distributed as $\text{Erlang}(5, 0.75)$. An $\text{Erlang}(k, \lambda)$ random variable can be generated from the sum of k i.i.d. exponential random variables with rate λ .

Turn in your (commented) computer program together with a sample of its output. Make sure that your computer program computes the statistics of interest, i.e. the total number of students who have completed their trips (NCS), fraction of time that a bike is available (waiting for customers in a dock) (FBA), the fraction of time that a dock is available (FDA), the average total time a student spends in the system (TIS), the average waiting time for a bike (WB), and the average waiting time for a dock (WD). Once the solution of Homework 5 is posted (by Friday night), you may want to compare with it to see how one could define the state variable and events.

- (b) (20 pts) Run your computer program for 50 replications, with each replication consisting of a full simulated day from 9am to 5pm. From each one of these 50 replications, report the statistics of interest. By using all 50 replications, also report a confidence interval for each of the statistics of interest.