1. Students arrive at Administrative Services Office at an average of one every 15 minutes, and their requests take on average 10 minutes to be processed. The service encounter is staffed by only one clerk, Judy Gumshoes, who works eight hours per day. Assume Poisson arrivals and exponential service times.
   a. What percentage of time is Judy idle?
   b. How much time, on average, does a student spend waiting in line?
   c. How much is the (waiting) line on average?
   d. What is the probability that an arriving student (just before entering the Administrative Services Office) will find at least one other student waiting in line?

2. The managers of the Administrative Services Office estimate that the time a student spends waiting in line costs them (due to goodwill loss and so on) $10 per hour. To reduce the time a student spends waiting, they know that they need to improve Judy’s processing time (see problem 1). They are currently considering the following two options:
   a. Install a computer system, with which Judy expects to be able to complete a student request 40 percent faster (from 2 minutes per request to 1 minute and 12 seconds, for example).
   b. Hire another temporary clerk, who will work at the same rate as Judy.
   If the computer costs $99.50 to operate per day, while the temporary clerk gets paid $75 per day, is Judy right to prefer the hired help? Assume Poisson arrivals and exponential service times.

3. Benny the Barber owns a one-chair shop. At barber college, they told Benny that his customers would exhibit a Poisson arrival distribution and that he would provide an exponential service distribution. His market survey data indicate that customers arrive at a rate of two per hour. It will take Benny an average of 20 minutes to give a haircut. Based on these figures, find the following:
   a. The average numbers of customers waiting.
   b. The average time a customer waits.
   c. The average time a customer is in the shop.
   d. The average utilization of Benny’s time.

4. Benny the Barber is considering the addition of a second chair. Customers would be selected for a haircut on a FCFS basis from those waiting. Benny has assumed both barbers would take an average of 20 minutes to give a haircut, and that business would remain unchanged with customers arriving at a rate of two per hour. Find the following information to help Benny decide if a second chair should be added:
   a. The average number of customers waiting.
   b. The average time a customer waits.
   c. The average time a customer is in the shop.