

**OPRE 6398 Prescriptive Analytics  
Homework 6**

**Due 4/08/19  
(11:59 p.m.)**

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Note: 1. Your homework submission must be typewritten.

2. be sure to show detail calculations to earn full credit.

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1. Read Reading 10 and 11.
2. Cars arrive at a single-station emission testing center in Frisco, TX, at a rate of five per hour and follow a Poisson distribution. The service times are exponentially distributed with an average of six minutes. Due to the unique location of the center, at any point in time only the first four cars in the system are parked at the facility and the rest are parked in a no-parking area on the street nearby, where there is a 20% chance of being fined \$25 per car.

The facility is open 48 hours per week, and each car will be picked up by the customer upon completion of the service. Find the weekly fines to be paid by the testing center.

3. Dairy Queen is a take-out yogurt shop owned by Linda Smith. Customers arrive at a rate of 20 per hour. Linda serves a customer, on the average, in 2 minutes. Assume that the arrivals and the service times are Poisson distributed and exponentially distributed, respectively.
  - (1) What is the probability that a customer will spend an average of 3 to 6 minutes in waiting for service?
  - (2) During the noontime rush, the arrival rate increases to one customer every 2.5 minutes. How fast does Linda have to work to ensure that a noontime customer will not spend an average of more than 5 minutes in the yogurt shop?
4. The DFW International Airport currently operates with one runway. Airplanes arrive at a rate of 17 per hour and the average landing time is three minutes. The estimated average fuel consumption for an aircraft stacking in the air is 10 liters per minute, and a liter of fuel costs \$20. Answer the following question under the assumptions of Poisson arrivals and exponential service times.
  - (1) What is the average number of planes stacking in the air and waiting for permission to land?
  - (2) What is the average cost of fuel burned by an aircraft waiting to land?
  - (3) What is the chance of finding less than three airplanes in the airport area including those that are in the waiting line and the one that is landing?
  - (4) How heavily is the runway used on the average?
5.
  - (1) Each of Professor A and Professor B at UTD has a private secretary, who can type four letters per hour. The letters are generated at a rate of three per hour by each of the two professors, who have been wondering if they would benefit from pooling the two secretaries. Perform a queuing analysis and make a recommendation to them on the basis of the average waiting time of a letter in the system.
  - (2) What is the implication, if any, of your findings in (1) above?