

Problem Set #3

ENEE 426, Spring 2009

Due: Monday, March 24

Complete the following problems:

1. (3 points) People arrive at an amusement park at a rate of 10 people per minute. The average customer spends 5 hours at the park. What is the average number of people in the amusement park?
2. (3 points) Customers arrive at a fast-food restaurant at a rate of five per minute and wait to receive their orders for an average of 5 minutes. Customers eat in the restaurant with probability 0.5 and carry out their order without eating with probability 0.5. A meal requires an average of 20 minutes. What is the average number of customers in the restaurant?
3. (8 points) Consider a supermarket check-out line where arrivals and departures have a Poisson distribution. Customers get in line at a rate of 1 customer per 3 minute. It takes an average of 2 minutes to scan groceries scanned and for customers to pay.
 - a. How long can a customer expect to wait in line?
 - b. How long can a customer expect to wait both in line, having their items scanned, and paying?
 - c. On average how long is the line?
4. (6 points) People arrive at a taxi stand at a rate of 2 per minute. Taxis arrive at a rate of 1 per minute. The inter-arrival and inter-departure times are exponentially distributed. The taxi stand can hold at most 5 taxis.
 - a. Compute the probability that at any given time, there are no taxis waiting.
 - b. Compute the probability that at any given time exactly 5 taxis are waiting.
5. (10 points) A switch has 4 interfaces each running at 10Mbps, connected to 4 computers C1, C2, C3, and C4. Packet lengths are exponentially distributed with an average length of 1000 bytes. The network is currently supporting 7 traffic flows as follows. C1 transmitting to C2 at a rate of 4 Mbps. C1 is transmitting to C4 at a rate of 2 Mbps. C2 is transmitting to C3 at a rate of 6 Mbps. C3 is transmitting to C2 at a rate of 2 Mbps. C3 is transmitting to C4 at a rate of 1 Mbps. C4 is transmitting to C1 at a rate of 5 Mbps. C4 is transmitting to C2 at a rate of 1 Mbps.
 - a. What is the average number of packets queued or being transmitted by the switch at any given time?
 - b. What is the average latency for each of the flows, assuming negligible processing and propagation delay?