Performance Analysis 2010, Homework 4

Problem 1 Consider two queues, both with Poisson arrivals with rate 1. Both have service times with mean 1/2. One is exponentially distributed, the other is deterministic. Compare the average waiting times, and queue lengths for the two queues.

Problem 2 The Won Hung Thee Chinese carry-out restaurant serves two dishse,s chow mein and spareribs. There are two separate windows, one for chow mein and one for spareribs. Customers arrive according to a Poisson process with a mean rate of $20/h$. 60% to go to the chow mein, and the rest to the rib window. Twenty percent of those who come from the chow mein window with their order go next to the rib window; the other 80% leave the restaurant. Ten percent of those who purchase ribs then go to the chow mein window, and the other 90% leave. It takes on average 4min to fill a chow-mein order and 5 min to fill a sparerib order, the service times being exponential. How many on average are in the restaurant? What is the average wait at each window? If a person wants both chow mein and ribs, how long, on average, does the person spend in the restaurant?

Problem 3 A call center that sells tickets for a local soccer team is modeled using 4 stations, A, B, C, and D, and routing probabilities as in this matrix.

$$\begin{bmatrix} .1 & .6 & .2 & \\ & & .1 & .8 \\ & .1 & & .8 \\ & & & \end{bmatrix}$$

(Not summing up to one indicates possibility for abandonment). There is 1 representative at each of nodes B, C, and D. Node A is an automatic answering service and can handle an arbitrary number of simultaneous calls. The service rates are $\mu_A = 120/h$, $\mu_B = 30/h$, $\mu_C = 10/h$, and $\mu_D = 30/h$. The arrival rate to the center is $\lambda = 30/h$. Suppose all the assumptions of an open Jackson network apply.

(a) Calculate the average number of customers in the system.

(b) Calculate the average time a customers spends in the system.