HW3

Deadline: 2016/5/25 (Wed.) 5:20 pm

1. We wish to determine the maximum call rate can be supported by one telephone booth. Assume that the mean duration of a telephone conversation is 3 min, and that no more than a 3-min (average) wait for the phone may be tolerated; what is the largest amount of incoming traffic can be supported?

2. Customers arrive at a fast-food restaurant at a rate of 5 per minutes and wait to receive their order for an average 3 minutes. Customers eat in the restaurant with prob. 0.5 and carry out their order without eating with prob. 0.5. A meal requires an average of 20 minutes. What is the average number of customers in the restaurant?

3. We have 2 systems. The first system is an M/M/2 queue with arrival rate 2λ and service rate μ while the second system is an M/M/1 queue with arrival rate 2λ and service rate 2μ. What system yields the smallest expected customer response time?

4. In a system, there are k machines and a single repairman. Each machine breaks down after a time that is exponentially distributed with parameter α. When a breakdown occurs, a request is sent to the repairman for fixing it. Requests are buffered. It takes an exponentially distributed amount of time with parameter μ for the repairman to repair a machine. What is the probability p(i) that i machines are up? What is the overall failure rate?

5. Consider a model of telephone switching system consisting of n trunks with a finite caller population of M callers and $n < M$. The average call rate of an idle caller is λ calls per unit time, and the average holding time of a call is $1/\mu$. If an arriving call finds all trunks busy, it is lost. Assuming that call holding times and the inter-call times of each caller are exponentially distributed. Find
   (a) the expected total traffic carried by the switching system per holding time.
   (b) the call congestion probability or the probability that a call is lost

6. Waiting time distribution for M/M/c. (Chap. 3 slides pp-31)

ANSWERING RULES:

1. You can answer the problems in English or Chinese.
2. Please submit a hard copy of your homework in class.
3. Remember to write down your name and student ID, if not you will get 10% penalty.
4. We allow you to hand over the homework after the deadline, but 10% penalty per day.
5. Please write the process of the calculation or some explanations of the answers. Do not just write the answers.
6. Do not cheat, or you will get 0%.