Homework Assignment #3

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1. The mean duration of a phone conversation is 3 mins calls per minute ( must be less than calls per minute to keep the system stable).

The average waiting time , where is the server utilization.

Since calls per minute.

1. Denote the arrival rate of customers that choose to eat in the restaurant as and that of those who carry out their orders as .

According to the Little’s Law, the average number of customers in the restaurant

1. Let and be the expected customer response time in systems 1 and 2, respectively.

Let and denote the mean number of customers in systems 1. According to the stationary queue-length d.f. in an M/M/c queue:

we have if from which we deduce that

Thus, for

by using the well-known identity for all From Little’s Law we deduce that

under the stability condition .

For the M/M/1 queue with arrival rate and service rate we have

under the stability condition . Since , system 2 is better.

1. Let be the number of machines up at time . It is easy to see that is a birth and death process with rates given by for for and for , respectively. We notice that has the same behavior as the queue-length process of an M/M/K/K queue: , for for , where Hence, we have for , where The overall failure rate is given by