Chapter 10

Queuing Systems

Exercises

10. 1.
At a small grocery store, customers arrive according to *Poisson* process with a mean of 15 customers per hour. The length of time it takes to check out is exponentially distributed with mean equal to 3 minutes.

1. Compute

   a) the probability that the checkout counter is idle,
   b) the probability that the checkout counter is busy,
   c) the probability that at least one customer is waiting to check out,
   d) the average number of customers waiting to check out,
   e) the average cost per customer, supposing that it costs the store 3 € for each minute that a customer spends waiting in the queue.

2. For an additional of 400 € per hour, the store can decrease the average service time to 2 minutes. Is the additional expenditure worthwhile?

10. 2.
A mechanic is able to install new car mufflers at an average rate of 3 per hour, according to a negative exponential distribution. Customers seeking this service arrive at the shop on the average of 2 per hours, following a Poisson distribution. They are served on a first-in, first-out basis and come from a very large (almost infinite) population of possible buyers.
Calculate the following:

1. The average number of cars in the system.
2. The average waiting time spent in the system.
3. The average number of cars waiting in the line.
4. The average waiting time per car.
5. The percentage of time the mechanic is busy (utilization factor).
6. The probability that there are no cars in the system.
7. The probability that there is only one car in the system

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