

Final Exam – Module 4 Questions

Please submit your answers via the Module 4 web form on the Coursera site.

Tom Opim

The following situation refers to Tom Opim, a first-year MBA student. In order to pay the rent, Tom decides to take a job in the computer department of a local department store. His only responsibility is to answer telephone calls to the department, most of which are inquiries about store hours and product availability. As Tom is the only person answering calls, the manager of the store is concerned about queuing problems.

Currently, the computer department receives an average of one call every 3 minutes, with a standard deviation in this interarrival time of 3 minutes. Tom requires an average of 2 minutes to handle a call. The standard deviation in this activity time is 1 minute.

The telephone company charges \$5.00 per hour for the telephone lines whenever they are in use (either while a customer is in conversation with Tom or while waiting to be helped). Assume that there are no limits on the number of customers that can be on hold and that customers do not hang up even if forced to wait a long time.

T01. For one of his courses, Tom has to read a book (*The Pole*, by E. Silvermouse). He can read 1 page per minute. Tom's boss has agreed that Tom could use his idle time for studying, as long as he drops the book as soon as a call comes in. How many pages can Tom read during an 8-hour shift?

T02. How long does a customer have to wait, on average, before talking to Tom?

T03. What is the average total cost of telephone lines over an 8-hour shift? Note that the department store is billed whenever a line is in use, including when a line is used to put customers on hold.

Philly Barber Shops

Newt Philly needs to decide where to get a haircut. He has narrowed the choice down to two local hair salons – Large Hair Salon (LHS) and Small Hair Cutters (SHC).

During busy periods, a new customer walks into LHS every 15 minutes (with a standard deviation of 15 minutes). At SHC, a customer walks in every hour (with a standard deviation of 1 hour). LHS has a staff of 4 barbers, while SHC has 1 barber. A typical service time at either salon lasts 30 minutes (with a standard deviation of 30 minutes).

PBS1. If Newt walks into LHS during a busy period, how long must he wait in line before he can see a barber? (Only include the waiting time, not any service time)

PBS2. If Newt goes to SHC, how long must he wait in line before his haircut starts?

PBS3. Assume that it takes Newt 10 minutes to leave work and walk to LHS and 10 minutes to walk back (i.e. each way of the walk takes 10 minutes). How long will he need to leave work for to get a haircut at LHS?

PBS4. LHS will buy out SHC. LHS will then close SHC's operations and serve all customers, including existing SHC customers, at the LHS location only. Assuming that the previous traffic of SHC customers now flows to the LHS location, what is the new inter-arrival time at LHS?

PBS5. To accommodate the new flow rate, LHS now staffs one additional barber (to increase the headcount to 5). What is the new waiting time at LHS? (Assume that the coefficient of variation of customer inter-arrival times is 1.)

Hospital Trauma Bays

The local hospital's emergency department has 6 trauma bays. On average, patients requiring a trauma bay arrive every 30 minutes (with a coefficient of variation of 1, no seasonality exists). If the hospital has an available trauma bay, it is immediately allocated to a needy patient. If there are no trauma bays available, the patient is sent to another hospital. On average, a patient's length of stay in a trauma bay is 1.5 hours (with a standard deviation of 1.5 hours). The hospital's emergency department operates 24 hours a day.

HTB1. What percentage of the patients requiring trauma bays end up being sent to another hospital? Please write your answer in decimal form (e.g. "0.15" for 15%)

HTB2. On average, how many patients are treated in the trauma bays on a 24-hour day? Your answer does not have to be an integer.

HTB3. The hospital updated the operating procedures for its staff. This led to a reduction in the mean to 1 hour and a reduction in the coefficient of variation of the length of stay in a trauma bay from 1.5 to 1.25. How will this training program affect the number of patients who have immediate access to a trauma bay?

a. No change

- b. More patients will have immediate access to a trauma bay
- c. Fewer patients will have immediate access to a trauma bay

HTB4. New state regulations require that every emergency department be able to accommodate at least 90% of all patients needing a trauma bay without any waiting. What is the minimum number of trauma bays necessary to meet this requirement? (Assume that the time spent in the trauma bay cannot be changed)

To-Do List

You have currently 7 items on your “to-do” list. Below are the items and the estimated times to complete them:

Restraining your <u>snow shoes</u> so you can get to class	- 120 minutes
Take a <u>nap</u>	- 100 minutes
Work on a <u>homework</u> assignment	- 80 minutes
Update your <u>Facebook</u> account	- 60 minutes
Call your <u>mother</u>	- 30 minutes
Eat some <u>food</u>	- 20 minutes
Call a <u>friend</u> to discuss weekend plans	- 10 minutes

TDL1. Suppose you start immediately with your tasks, no other tasks get added to your to-do list today, and you sequence them so as to minimize the average time the tasks wait before you start them. What will you be doing in 190 minutes from the time that you start?

- a. Snow shoes
- b. Nap
- c. Homework
- d. Facebook
- e. Mother
- f. Food
- g. Friend

YourNurse

YN1. YourNurse (YN) Inc uses certified nurses to answer medical queries from customers over the phone. When patients call into YN they are first asked to provide their zip code, which then

allows YN to route their call to the call center nearest to the patient (they operate 10 centers across the country). Which single suggestion in the following list (and explanation) is most likely to reduce the average time callers wait before speaking with a nurse?

- a) Run an advertising campaign to increase demand and to better utilize their nurses.
- b) Train their nurses so that they spend more time answering the patients' questions.
- c) Instead of using callers' zip codes, route calls to the call center with the fewest callers to help prevent situations in which there are idle nurses at the same time that there are callers on hold.
- d) Play a recording of useful medical information while callers are on hold so as to decrease their perception of how long they are waiting.
- e) None of the above