

Module 4 – Practice Questions

Concierge

Consider the concierge service at a large resort. The concierge helps guests with various tasks, including reservations at local restaurants or offering advice on various local activities. On average, 12 guests arrive at the concierge desk per hour (the standard deviation of the inter-arrival times is equal to 5 minutes). The hotel has only one concierge on service. It takes the concierge, on average, 4 minutes to help the guest with their questions. The standard deviation of this time is three minutes.

C1. What is the average time a guest has to wait before talking to the concierge?

C2. How many guests will, on average, be at the concierge's desk (either talking to the concierge or waiting in line)? (Your answer does NOT have to be an integer.)

MusicVenue

MusicVenue is a concert organizer that is evaluating the installation of portable toilets in the arena where a concert is going to take place. In particular, they are considering giving service to a part of the complex that is far away from the existing restrooms. Assume there will be one single queue to access all portable toilets in this area and that only one person uses a toilet at a time. There are 2 arrivals per minute on average, the standard deviation of the time between arrivals is 15 seconds, and the average time a person spends in the toilet is 4 minutes (with standard deviation 1 minute).

Suppose MusicVenue decides to install 10 portable toilets.

MV1. What is the average utilization of the 10 toilets?

MV2. What is the expected time a customer will have to wait?

MV3. How long will the average toilet be empty during a 5-hour concert?

MV4. What is going to be the average number of people in the queue? (Your answer does NOT have to be an integer.)

MV5. The firm does not want the average waiting time to be higher than 2 minutes. What is the minimum number of portable toilets that the firm will have to install to meet that goal? (Your

answer should be an integer – they can install 2 toilets or 3 toilets but they cannot install 2.6 toilets)

TechCall

TechCall has started a phone service that uses overseas computer technicians to provide technical consultations. The responding technicians are based in a country with low wages but with a highly skilled pool of technicians. Responding to each call takes on average 20 minutes. At any given time, there are 5 technicians overseas on duty. Calls arrive every 5 minutes on average (standard deviation is 5 minutes). The company receives \$40 per consultation. If one of the 5 overseas technicians is available, the firm pays \$15 to the technician and makes \$25 in profit. If no technician is available overseas, the call is re-routed to the US where a local technician answers the question. A local technician is always available to take a call. In this case, the firm pays the \$40 to the local technician, so there's no profit for the company.

TC1. What is the probability of a call being answered by a technician in the US? (Please give the answer as a decimal between 0 and 1)

TC2. What is the probability of a call being answered by a technician in the US if the company increases the number of on-duty overseas technicians to 10? (Please give the answer as a decimal between 0 and 1)

TC3. What would be the additional revenue, in dollars per hour, obtained if the company managed to have 10 technicians overseas on duty at any given time?

TC4. What would be the additional profit, in dollars per hour, be if the company managed to have 10 technicians overseas on duty at any given time?

Computer Priority

A computer server currently has a queue of 5 jobs, sequenced from A to E with A being the one that has been waiting the longest and E being the one that was most recently received. The following table provides their processing times in milliseconds:

	A	B	C	D	E
Time (milliseconds)	5	78	50	2	15

CP1. Suppose the server is designed to minimize the average waiting time across jobs (i.e., time in queue waiting to start processing). Ignore the amount of time these jobs have already been waiting, and suppose that the server is immediately available to start working on one of the jobs and that the server is aware of each job's processing time. What is the *minimum total time* these five jobs will wait before beginning processing? (Additional jobs may or may not arrive before the processing of these jobs is completed.) For example, if A is processed first and B next, then A's wait will be 0 and B's wait will be 5 (the time to complete A), so the total wait time for these two jobs alone is $0 + 5 = 5$.