

Question 1 (1 point)

In queuing problems, which of the following probability distributions is typically used to describe the **number of arrivals** per unit of time?

- Poisson
- Normal
- Binomial
- Lognormal

Question 2 (1 point)

In queuing problems, which of the following probability distributions is typically used to describe **the time to perform the service**?

- Normal
- Exponential (or Negative Exponential)
- Binomial
- Lognormal

Question 3 (2 points)

Management is considering implementing a technology improvement in its service system. The new technology would cut variability of service time by 10% but would not alter its mean. It would also not impact arrival rates, number of servers or queue capacity. Moreover, as with the current system, no customers would be blocked or abandon due to long waits.

With the new technology, the average waiting time in queue would ____ (i) ____ and the average server utilization would ____ (ii) ____

- (i) decrease, (ii) remain unchanged
- (i) decrease, (ii) decrease
- (i) decrease, (ii) increase
- (i) increase, (ii) remain unchanged
- (i) remain unchanged, (ii) increase

Question 4 (1 point)

All the following are characteristics of a M/M/1 system EXCEPT:

- exponential service time pattern
- single number of channels
- limited population size
- single number of phases
- Poisson arrival rate pattern

Question 5 (1 point)

All following are disadvantages of a single line for a multiple server queuing system EXCEPT

- It might appear too long for customers.
- Servers may not work as fast as if they were responsible for their own line.
- Customers can't choose their favourite server.
- It increases average wait time for customers.
- It may take up too much space.

Question 6 (2 points)

Three parts of a waiting line or queuing system are

- distribution of arrival times, discipline while waiting, and distribution of service times
- arrival or inputs, queue discipline or the waiting line itself, and the service facility
- sequencing policy, penalty for renegeing, and expediting of arrivals
- arrival rate, service rate, and utilization rate
- arrival discipline, queue discipline, and service sequencing

Question 7 (1 point)

An example of unlimited queue is

- small barbershop with only 5 chairs for waiting customers
- faculty office with limited seating during office hours
- toll booth serving automobiles on an interstate
- drive-through lane at a fast-food restaurant
- restaurant with no outside seating and limited capacity due to fire department restrictions

Question 8 (2 points)

A single-phase waiting-line system meets the assumptions of constant service time or M/D/1. Units arrive at this system every 12 minutes on average. Service takes a constant 8 minutes. The average length of the queue (l_q) is approximately :

2.5

7.5

4.5

5

0.67

Question 9 (2 points)

A post office has a single line for customers waiting for the next available postal clerk. There are two postal clerks who work at the same rate. The arrival rate of customers follows a Poisson distribution, while the service time follows an exponential distribution. The average arrival rate is three per minute and the average service rate is two per minute for each of the two clerks. What proportion of time are both clerks idle?

0.143

0.750

0.250

0.643

Question 10 (3 points)

Using the information provided in Table below, counting each person being served and the people in line, on average, how many customers would be in this system? (select the nearest answer)

M/M/2	
Mean Arrival Rate:	20 customers/hour
Mean Service Rate:	12 customers/hour
Number of Servers:	2
Server wage	\$10/hour
Customer waiting cost	\$20/hour
Probability of zero customers in system:	0.280

5.05

7.56

5.45

4.85

6.15

Question 11 (6 points)

A regional family health team helps people with organizing appointments with their family physicians. It has seven staff members taking calls from patients. On average, they receive one call every six minutes (with standard deviation of six). Each staff member spends 20 minutes with each caller (on average, with a standard deviation of 30) to assist them with their needs.

Note: Provide your detailed calculations in the text box.

- a) What is the probability that one of its staff members is busy (as a percent) ? (2 marks)

- b) How long (in minutes) does a caller spend, on average, waiting on hold before he or she can start speaking with a representative ? (4 marks)

Question 12 (6 points)

A small startup called CodeAcademy provides quick programming solutions to students and professional clients. Clients submit their codes to the CodeAcademy website and a professional programmer will be assigned to their request to assist them with their request. The CodeAcademy has five full-time professional programmers who do all of the coding. On average, a request arrives once every 4.8 hours, with a standard deviation of 6.0 hours. Each submitted request is assigned to one programmer and the programmer takes on average 19.2 hours to complete each request, with a standard deviation of 19.2 hours.

How many uncompleted request does CodeAcademy have in the system on average at any given time? (Include coding requests waiting for a programmer as well as those being programmed.)

Note: Provide your detailed calculation in the text box.