

ISDS 361B Queuing Review

Customers arrive to the a bank at a rate of 15 per hour. There are two open tellers and the average service time is 6 minutes. Assume Poisson arrival and exponential service time. 20% of the customers are sent by the teller (after giving them the service) to see the manager which takes exactly 15 minutes to resolve an issue.

1. How long (in minutes) does it take, on the average, from the moment a customer enters the bank until he/she are done with the teller?
a. 7.71 b. 9.71 c. 11.71 *d. 13.71 e. none of the above
2. How long, on the average in minutes, does it take a customer from the moment he/she steps into the bank until he/she is out when the customer needs also to see the manager?
a. 22.71 b. 28.71 c. 45.21 *d. 51.21 e. none of the above
3. How long (in minutes) does a customer wait to see the manager?
a. 15 *b. 22.5 c. 27.5 d. 37.5 e. none of the above
4. What proportion of the time is the manager busy?
a. 0.2 b. 0.25 *c. 0.75 d. 0.8 e. None of the above
5. How many customers are in the bank, on the average?
a. 1.88 b. 3.43 c. 4.27 *d. 5.31 e. none of the above

During peak hours you get 48 calls per hour on your one toll free service number. You have two operators answering the calls on a first come first serve basis. Answering a call takes about two minutes. Assume that calls arrive in a Poisson process and service time is exponential.

6. What is the average time (in minutes) a caller is put on hold?
a. 8 *b. 3.56 c. 10 d. 5.56 e. none of the above
 7. What is the average number of customers which are on hold?
*a. 2.84 b. 3.2 c. 4.44 d. 6.4 e. none of the above
 8. What is the average time (in minutes) from the moment a call is received until the customer completed the call?
a. 8 b. 3.56 c. 10 *d. 5.56 e. none of the above
 9. What is the average number of customers getting service?
a. 0.8 b. 1 *c. 1.6 d. 2 e. none of the above
- Now suppose you split your service to two independent lines, one operator per line, each getting half of the calls.**
10. What is the average time (in minutes) a caller is put on hold?
*a. 8 b. 3.56 c. 10 d. 5.56 e. none of the above

11. What is the average number of customers which are on hold (for both lines)?
 a. 2.84 *b. 3.2 c. 4.44 d. 6.4 e. none of the above
12. What is the average time (in minutes) from the moment a call is received until the customer completed the call?
 a. 8 b. 3.56 *c. 10 d. 5.56 e. none of the above
13. What is the average number of customers getting service?
 a. 0.8 b. 1 *c. 1.6 d. 2 e. none of the above
- A TV/VCR repairman gets about two instruments to fix in a 12 hour day. It takes him about three hours to fix an instrument. Assume Poisson arrival and Exponential service time.**
14. How many hours, on the average, it takes from the time you bring your instrument until it is ready to be picked up?
 *a. 6 b. 0.5 c. 12 d. 1 e. None of the above
15. How many instruments, on the average, are waiting to be fixed?
 a. 2.25 b. 4.17 *c. 0.5 d. 1.33 e. None of the above
16. How many instruments, on the average, are in the store (including those which are being fixed)?
 *a. 1 b. 2 c. 3 d. 5 e. None of the above
17. What is the probability that you arrive at the store and see no instruments either waiting or being fixed.
 a. 0.25 * b. 0.5 c.0.33 d. 0.17 e. None of the above
- Since waiting time for customers seems to be too long, the repairman added an assistant who is experienced and fixes the instruments in the same average time. Assume Poisson arrival and Exponential service time.**
18. How many hours, on the average, it takes from the time you bring your instrument until it is ready to be picked up?
 a. 2.42 b.3.49 c. 2.25 *d. 3.20 e. None of the above
19. How many instruments, on the average, are waiting to be fixed?
 *a. 0.033 b. 0.083 c. 0.123 d. 0.175 e. None of the above
20. How many instruments, on the average, are in the store (including those which are being fixed)?
 a. 0.873 *b. 0.533 c. 0.75 d. 1.01 e. None of the above

21. What is the probability that you arrive at the store and see no instruments either waiting or being fixed.

*a. 0.6 b. 0.412 c. 0.45 d. 0.5 e. None of the above

Cars arrive at a toll booth at a rate of 5 per minute. It takes, on the average 7.5 seconds to pay toll with a standard deviation of 2.4 seconds. Assume Poisson arrival.

22. What is the average number of cars waiting in line?

*a. 0.574 b. 1.199 c. 3.376 d. 4.251 e. none of the above

23. What is the average number of cars in the system?

a. 0.574 *b. 1.199 c. 3.376 d. 4.251 e. none of the above

24. What is the average time (in seconds) from the moment a car approaches the line until it is paid and leaves the toll booth?

a. 6.89 *b. 14.39 c. 28.94 d. 36.44 e. none of the above

25. How long (in seconds) do cars wait in line?

*a. 6.89 b. 14.39 c. 28.94 d. 36.44 e. none of the above

Students come to Carl Jr. at a rate of 70 per hour. There are two servers and providing the service takes about 1.2 minutes. Assume Poisson arrival and Exponential service.

26. What is the average time (in minutes) from the moment a student enters Carl Jr. until he gets his order completed?

a. 1.15 b. 5.12 *c. 2.35 d. 6.32 e. none of the above

27. What is the average time (in minutes) that the student waits in line?

*a. 1.15 b. 5.12 c. 2.35 d. 6.32 e. none of the above

28. What is the average number of students waiting in line?

a. 9.47 b. 7.67 c. 2.75 *d. 1.35 e. none of the above

29. What is the average number of students in the restaurant?

a. 9.47 b. 7.67 *c. 2.75 d. 1.35 e. none of the above

30. What is the average number of students whose order is being taken?

a. 2.0 *b. 1.4 c. 1.6 d. 1.8 e. none of the above.