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2. Benny's Arcade has six video game machines. The average time between machine failures is 50 hours. Jimmy, the maintenance engineer, can repair a machine in 15 hours on average. The machines have an exponential failure distribution, and Jimmy has an exponential service-time distribution.
 - a. What is Jimmy's utilization?
 - b. What is the average number of machines out of service, that is, waiting to be repaired or being repaired?
 - c. What is the average time a machine is out of service?
3. Moore, Aiken, and Payne is a dental clinic serving the needs of the general public on a first-come, first-served basis. The clinic has three dental chairs, each staffed by a dentist. Patients arrive at the rate of five per hour, according to a Poisson distribution, and do not balk or renege. The average time required for a dental checkup is 30 minutes, according to an exponential distribution.
 - a. What is the probability that no patients are in the clinic?
 - b. What is the probability that six or more patients are in the clinic?
 - c. What is the average number of patients waiting in the lobby?
 - d. What is the average total time that a patient spends in the clinic?
4. Fantastic Styling Salon is run by two stylists, Jenny Perez and Jill Sloan, each capable of serving five customers per hour, on average. Eight customers, on average, arrive at the salon each hour.
 - a. If all arriving customers wait in a common line for the next available stylist, how long would a customer wait in line, on average, before being served?
 - b. Suppose that 50 percent of the arriving customers want to be served only by Perez and that the other 50 percent want only Sloan. How long would a customer wait in line, on average, before being served by Perez? By Sloan? What is the average customer waiting time in the line?
 - c. Do you observe a difference in the answers to parts (a) and (b)? If so, why? Explain.
5. You are the manager of a local bank where three tellers provide services to customers. On average, each teller takes three minutes to serve a customer. Customers arrive, on average, at a rate of 50 per hour. Having recently received complaints from some customers that they waited a long time before being served, your boss asks you to evaluate the service system. Specifically, you must provide answers to the following questions:
 - a. What is the average utilization of the three-teller service system?
 - b. What is the probability that no customers are being served by a teller or are waiting in line?
 - c. What is the average number of customers waiting in line?
 - d. On average, how long does a customer wait in line before being served?
 - e. On average, how many customers would be at a teller's station and in line?
6. Jake Tweet hosts a psychology talk show on KRAN radio. Jake's advice averages 10 minutes per caller but varies according to an exponential distribution. The average time between calls is 25 minutes, exponentially distributed. Generating calls in this local market is difficult, so Jake does not want to lose any calls to busy signals. The radio station has only three telephone lines. What is the probability that a caller receives a busy signal?
7. The supervisor at the Precision Machine Shop wants to determine the staffing policy that minimizes total operating costs. The average arrival rate at the tool crib, where tools are dispensed to the workers, is eight machinists per hour. Each machinist's pay is \$20 per hour. The supervisor can staff the crib either with a junior attendant who is paid \$5 per hour and can process 10 arrivals per hour or with a senior attendant who is paid \$12 per hour and can process 16 arrivals per hour. Which attendant should be selected, and what would be the total estimated hourly cost?
8. The daughter of the owner of a local hamburger restaurant is preparing to open a new fast-food restaurant called Hasty Burgers. Based on the arrival rates at her father's outlets, she expects customers to arrive at the drive-up window according to a Poisson distribution, with a mean of 20 customers per hour. The service rate is flexible; however, the service times are expected to follow an exponential distribution. The drive-in window is a single-server operation.
 - a. What service rate is needed to keep the average number of customers in the service system (waiting line and being served) to four?
 - b. For the service rate in part (a), what is the probability that more than four customers are in line and being served?
 - c. For the service rate in part (a), what is the average waiting time in line for each customer? Does this average seem satisfactory for a fast-food business?
9. The manager of a branch office of Banco Mexicali observed that during peak hours an average of 20 customers arrives per hour and that there is an average of 4 customers in the branch office at any time. How long does the average customer spend waiting in line and being serviced?
10. Paula Caplin is manager of a major electronics repair facility owned by Fisher Electronics. Recently, top management expressed concern over the growth in the number of repair jobs in process at the facility. The average arrival rate is 120 jobs per day. The average job spends 4 days at the facility.
 - a. What is the current work-in-process level at the facility?
 - b. Suppose that top management has put a limit of one-half the current level of work-in-process. What goal must Paula establish and how might she accomplish it?

