d. The average number of patients in the queue waiting for service?
e. The average time (hours) a patient spends in the queue waiting?
f. The probability that the patient, upon arrival, must wait?

9-2 The following data have been collected from a hospital pharmacy. This service system operates as a single server, single channel system.

	7–3 PM	*3–11 PM*	*11–7 AM*
Service rate per hour	200	100	50
Arrival rate per hour	60	50	40

The service rate can be increased or decreased in increments of 50 prescriptions per hour. The expense associated with each 50-prescription increment is $100. In other words, to be able to process 50 additional prescriptions will cost an additional $100 per hour. If the current rate of processing or service is lowered by 50 prescriptions per hour, the savings are $100 per hour. Using queuing theory, describe this service system. What is:

a. The probability that the clinic is idle—no patients waiting or being served?
b. The average number of patients in the system?
c. The average time (hours) a patient spends in the system (waiting + service time)?
d. The average number of patients in the queue waiting for service?
e. The average time (hours) a patient spends in the queue waiting?
f. The probability that a patient, upon arrival, must wait?

Given the associated costs, should the service rate be changed? What are the financial implications associated with your recommendations?

9-3 Consider the data in Table 9-6. This table reports the number of a specific lab test received for processing at an outpatient medical lab over a 10-day period of time. Based on machine capabilities and staffing, the service rate for the day shift (7 AM–3 PM) must be constant even though the arrival rate changes during this time period. The system currently operates as a single channel single server system.

a. What service rate do you recommend for the day shift (7 AM–3 PM)? Remember that the service rate must be greater than the arrival rate. Use queuing parameters to describe this system with different service rates.
b. What are the implications of changing this system from a single server to a multiple server system in which S = 2. Show the queuing theory parameters. How would management make this decision?