- (1) The probability that a patient recovers from a stomach disease is .8. Suppose 20 people are known to have contracted this disease. What is the probability that
  - (a) exactly 14 recover?
  - (b) at least 10 recover?
  - (c) at least 14 but not more than 18 recover?
  - (d) at most 16 recover?
- (2) The National Fire Incident Reporting Service stated that, among residential fires, 73% are in family homes, 20% are in apartments, and 7% are in other types of dwellings. If four residential fires are independently reported on a single day, what is the probability that two are in family homes, one is in an apartment, and one is in another type of dwelling?
- (3) The typical cost of damages caused by a fire in a family home is \$20,000. Comparable costs for an apartment fire and for fire in other dwelling types are \$10,000 and \$2000, respectively. If four fires are independently reported, use the information in Problem (2) to find the
  - (a) expected total damage cost.
  - (b) variance of the total damage cost.
- (4) Customers arrive at a checkout counter in a department store according to a Poisson distribution at an average of seven per hour. During a given hour, what are the probabilities that
  - (a) no more than three customers arrive?
  - (b) at least two customers arrive?
  - (c) exactly five customers arrive?
- (5) Show that  $MSE(\hat{\theta}) = E[(\hat{\theta} \theta)^2] = Var(\hat{\theta}) + (B(\hat{\theta}))^2$ .
- (6) (a) If  $\hat{\theta}$  is an unbiased estimator for  $\theta$ , what is  $B(\hat{\theta})$ ?
  - (b) If  $B(\hat{\theta}) = 5$ , what is  $E(\hat{\theta})$ ?
- (7) Suppose that  $\hat{\theta}$  is an estimator for a parameter  $\theta$  and  $E(\hat{\theta}) = a\theta + b$  for some nonzero constants a and b.
  - (a) In terms of a, b, and  $\theta$ , what is  $B(\hat{\theta})$ ?
  - (b) Find a function of  $\hat{\theta}$  say,  $\hat{\theta}^*$  that is an unbiased estimator for  $\theta$ .
- (8) Suppose that  $Y_1, Y_2, Y_3$  denote a random sample from a population with probability density function

$$f(y) = \begin{cases} \left(\frac{1}{\theta+1}\right) e^{-y/(\theta+1)} & y > 0, \ \theta > -1 \\ 0 & \text{elsewhere} \end{cases}$$

Suggest a suitable statistic to use as an unbiased estimator for  $\theta$ .

- (9) Most Americans love participating in or at least watching sporting events. Some feel that sports have more than just entertainment value. In a survey of 1000 adults, conducted by KRC Research & Consulting , 78% felt that spectator sports have a positive effect on society.
  - (a) Find a 95% confidence interval for the percentage of the public that feel that sports have a positive effect on society.
  - (b) The poll reported a margin of error of " plus or minus 3.1%." Does this agree with your answer to part (a)? What value of p produces the margin of error given by the poll?
- (10) Two brands of refrigerators, denoted A and B, are each guaranteed for 1 year. In a random sample of 50 refrigerators of brand A, 12 were observed to fail before the guarantee period ended. An independent random sample of 60 brand B refrigerators also revealed 12 failures during the guarantee period. Estimate the true difference  $(p_1 p_2)$  between proportions of failures during the guarantee period, with confidence coefficient approximately .98.