b. In this scenario, there is a fixed number of trials, namely $n = 250$. These trials are independent since where one applicant lives does not affect where the next applicant lives. For each applicant, there are only two possible outcomes for where the applicant lives: in-state or not in-state. Thus, a binomial distribution should be used.

c. In the last scenario, there is a fixed number of trials, namely $n = 50$. However, these trials are dependent since the probability of getting a coupon changes with each program that is handed out. With a fixed number of dependent trials, use a hypergeometric distribution.

5.4 Section Exercises

Probability for Hypergeometric Distributions

Find each specified probability for the given scenario. Assume that every scenario follows a hypergeometric distribution.

1. In a standard deck of 52 cards, 13 are hearts. Assume that 5 cards are selected without replacement out of a well-shuffled deck.

a. What is the probability of getting exactly 2 hearts?

b. What is the probability that all 5 cards will be hearts?

c. What is the average number of hearts you would be dealt in five cards?

2. Suppose that one Christmas, Abby and Andrew's mother forgot to label their gifts. Out of ten wrapped presents, five are for Abby and five are for Andrew.

a. What is the probability that exactly one of the first four presents opened is for Abby?

b. What is the probability at most three of the first five gifts opened are for Andrew?

c. Of the first four presents opened, what is the average number that would be for Abby?

3. Suppose that 12 of the 20 azaleas for sale at a large nursery have pink flowers and the rest have red flowers. Because it is early in the season, they have not begun to bloom and you cannot yet tell what color each plant will be.

a. If eight azaleas are chosen at random without replacement, what is the probability that exactly 6 will be pink?

b. If five azaleas are chosen at random without replacement, what is the probability that none of the azaleas will be pink?

c. Calculate the variance for this hypergeometric distribution in part b.

4. Eloise loves jelly beans, and the yellow ones are her favorite. One afternoon she is snacking on a bag of 18 jelly beans, 5 of which are yellow. She grabs a handful of 6 jelly beans.

a. What is the probability that more than half of the jelly beans in her hand are yellow?

b. What is the probability that fewer than 2 of the jelly beans in her hand are yellow?

c. Calculate the variance for this hypergeometric distribution.

5. The manager of a furniture store has just received a shipment of sofas and recliners. He knows that the order contains five sofas and nine recliners.

a. What is the probability that the first three items brought into the store are recliners?

b. What is the probability that out of the first seven items brought into the store, no more than two are sofas?

6. Suppose Audrey received a box of chocolates for Valentine's Day. Just after opening the box, she lost the paper which had the description of each chocolate on it. However, she knows that there were six truffles and five caramel candies left.

a. What is the probability that the first two chocolates she eats are both truffles?

b. What is the probability that at least one of the first three chocolates she eats is caramel?

7. Karen has 20 squares of material to use for her quilt; 8 are polka-dotted and the rest are floral.

a. What's the probability that she randomly uses all floral squares for the first 5 pieces of the quilt?

b. What's the probability that 2 out of the first 6 pieces she randomly chooses are polka-dotted?

8. Jay has ten pieces of mail to open, four of which are junk mail.

a. What is the probability that he randomly opens two pieces of mail and they are both junk mail?

b. What is the probability that he randomly opens three pieces of mail and at least two of them are junk mail?

9. Grab bags at the town festival are filled with either a coupon for a free hamburger or a coupon for a free order of french fries. Suppose there are 22 hamburger coupons left and 18 french-fry coupons left.

a. What is the probability that you and your friend both get bags with hamburger coupons in them?

b. Given that you both got hamburger coupons, what is the probability that if you each choose again, you both get french-fry coupons?

10. Suppose there are eight green tags, twelve white tags, and four red tags left to use as name tags at a conference. Tags are given out randomly at the registration desk.

a. What is the probability that the first two tags given out are red?

b. What is the probability that if part a. did happen, then more than three out of the next five tags would be white?

11. An antiques dealer has fifteen antique cedar chests for sale. Unknown to the dealer, one of these cedar chests is actually a modern reproduction. If the dealer randomly chooses three of these cedar chests for display, what is the probability that one of the cedar chests on display will be the reproduction?

12. Of the 30 pairs of size 8 jeans on the display table at a local retail store, 2 of the pairs are incorrectly labeled with the wrong size. A customer comes into the store and randomly chooses 5 pairs of jeans from the table, believing them all to be the same size.

a. What is the probability that all 5 pairs of jeans that the customer chose are the correct size?

b. What is the probability that 1 of the 5 pairs of jeans that the customer chose is incorrectly labeled?

c. What is the probability that both of the incorrectly labeled pairs of jeans are in the 5 pairs that the customer chose?

Determining Which Discrete Probability Distribution to Use

Each of the following exercises can be solved using the binomial distribution, the Poisson distribution, or the hypergeometric distribution. Begin by stating which distribution to use, and then solve the problem.

13. A bank receives an average of 8 bad checks per day. What is the probability that during a five-day bank week, the bank will receive 50 bad checks?

14. The IRS is considering auditing 250 tax returns within a given region, 15 of which have serious errors (unknown to the IRS, of course). If an IRS agent randomly chooses 25 of these 250 tax returns on which to perform an audit, what is the probability that 3 of these tax returns will have serious errors?

15. It is commonly stated that one out of every two marriages will end in divorce. Assuming this is true, what is the probability that of ten randomly selected married couples, seven of the couples' marriages will end in divorce?

16. According to records from a large public university, 85% of students who graduate from the university successfully find employment in their chosen field within six months of graduation. What is the probability that of eight randomly selected students who have graduated from this university, at least five of them find employment in their chosen field within six months?

17. Suppose that one of a local breeder's ten newborn poodles has a genetic birth defect that will only appear later in life. Due to the high expense of the testing, the breeder randomly chooses only three puppies to test for genetic birth defects. What is the probability that one of the puppies will test positive for a genetic birth defect?

18. If a child welfare office receives an average of five reports of child abuse per day, what is the probability that the child welfare office will have a slow day and receive no more than two reports?