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Chapter 4: Geometric and Hypergeometric Distributions

1. Identify the most suitable discrete probability distribution for each scenario.
   a) the number of clubs in a hand of 10 cards dealt from a standard deck
   b) the number of attempts before rolling a six with a die
   c) the number of 3s produced by a random number generator that generated 20 numbers
   d) the number of defective screws in a random sample of 20 taken from a production line that has a 2% defect rate
   e) the number of left-handed people in a group selected from a community comprised equally of left-handed and right-handed people.

2. A poll indicated that 34% of the population agreed with a recent policy paper issued by the government.
   a) What is the probability that the pollster would have to interview five people before finding a supporter of the policy?
   b) What is the expected waiting time before the pollster interviews someone who agrees with the policy?

3. Suppose that 1 out of 50 cards in a scratch-and-win promotion gives a prize.
   a) What is the probability of winning on your fourth try?
   b) What is the probability of winning within your first four tries?
   c) What is the expected number of cards you would have to try before winning?

4. In a class of 20 students, 5 are bilingual. If the class is randomly divided into 4 project teams,
   a) what is the probability that a team has fewer than 2 bilingual students?
   b) what is the expected number of bilingual students on a team?

5. Earlier this year, 520 seals were caught and tagged. On a recent survey, 30 out of 125 seals had been tagged.
   a) Estimate the size of the seal population.
   b) Explain why you cannot calculate the exact size of the seal population.

6. A calculator manufacturer checks for defective products by testing 3 calculators out of every lot of 12. If a defective calculator is found, the lot is rejected.
   a) Suppose 2 calculators in a lot are defective. Calculating the probability that the lot will be rejected.
   b) The quality-control department wants to have at least a 30% chance of rejecting lots that contain only one defective calculator. Is testing 3 calculators in a lot of 12 sufficient? If not, how would you suggest they alter their quality-control techniques to achieve this standard? Support your answer with mathematical calculations.

7. It has been stated that about 32% of Canadians aged 25 to 64 have a high school diploma but do not pursue any further education.
   a) If 20 Canadians in the age group are randomly selected, find the probability that at most 3 of them have a high school diploma but do not pursue any further education.
   b) How many of the selected do you expect to have a high school diploma but do not pursue any further education?

8. Under what conditions would a binomial distribution be a good approximation for a hypergeometric distribution?

9. The door prizes at a dance are four $10 gift cards, five $20 gift cards, and three $50 gift cards. The prize envelopes are mixed in a bag, and five prizes are drawn at random.
   a) What is the probability that none of the prizes is a $10 gift card?
   b) What is the expected number of $20 gift cards drawn?

10. A research company has 50 employees, 20 of whom are over 40 years old. Of the 22 scientists on the staff, 12 are over 40. Compare the expected numbers of older and younger scientists in a randomly selected focus group of 10 employees.

11. The lifetime risk of developing pancreatic cancer is about one in seventy-eight.
    a) What is the probability of that you ask ten people before one says he or she has pancreatic cancer?
    b) What is the probability that you must ask 20 people before meeting one?
    c) What is the expected number of people you must ask before meeting one?