

1 Lesson 12 Additional Exercise 3

There are 25 coins in a jar. 15 are quarters, 7 are dimes, and 3 are pennies. Each time you reach in the jar, you are equally likely to pick any of the coins in the jar. The coins are not replaced in the jar after each draw. What is the minimum number of times you must reach in the jar to have at least a 50% chance of getting all 3 pennies? (Hint: In this question, n is unknown. You will have to try a few different values of n to get the answer).

2 Answer

We use the hypergeometric distribution to calculate the probability of drawing all 3 pennies:

$$P(X = 3) = \frac{\binom{3}{3} \binom{22}{n-3}}{\binom{25}{n}}$$

2.1 Calculate for Different Values of n

For $n = 3$:

$$P(X = 3) = \frac{\binom{3}{3} \binom{22}{0}}{\binom{25}{3}} \approx 0.00043$$

For $n = 10$:

$$P(X = 3) = \frac{\binom{3}{3} \binom{22}{7}}{\binom{25}{10}} \approx 0.05218$$

For $n = 15$:

$$P(X = 3) = \frac{\binom{3}{3} \binom{22}{12}}{\binom{25}{15}} \approx 0.1978$$

For $n = 20$:

$$P(X = 3) = \frac{\binom{3}{3} \binom{22}{17}}{\binom{25}{20}} \approx 0.4956$$

For $n = 21$:

$$P(X = 3) = \frac{\binom{3}{3} \binom{22}{18}}{\binom{25}{21}} \approx 0.5783$$

2.2 Conclusion

You must reach a minimum of 21 times in the jar to have at least a 50% chance of getting all 3 pennies