Ricky Takes 2 Coins At Random From 3 Quarters, 5 Dimes, And Two Nickels In His Pocket.1) What Is The

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Introduction

Imagine Ricky reaching into his pocket, where he has a mixture of coins—specifically, 3 quarters, 5 dimes, and 2 nickels. Without looking, he randomly picks out two coins. This simple act might seem straightforward, but it opens the door to a fascinating exploration of probability, combinations, and coin values.

Understanding the likelihood of different outcomes when selecting coins at random is a common problem in probability theory. It's a fundamental concept that applies not only in theoretical mathematics but also in real-world scenarios such as games of chance, financial calculations, and decision-making processes.

In this article, we will analyze the problem step-by-step, exploring the possible combinations Ricky might pick, calculating the probability of each, and understanding the implications of these outcomes. This detailed examination will help clarify concepts such as probability distribution, combinations, and expected value, all within the context of coins and everyday transactions.

The Coin Collection: Details and Counts

Before diving into the calculations, it's essential to understand the composition of Ricky's coin collection:

- Quarters: 3 coins (each worth 25 cents)
- Dimes: 5 coins (each worth 10 cents)
- Nickels: 2 coins (each worth 5 cents)

Total coins in Ricky's pocket:
3 (quarters) + 5 (dimes) + 2 (nickels) = 10 coins

Ricky randomly selects 2 coins from these 10 without replacement, meaning once a coin is chosen, it's not put back into the pocket before the second pick.

The goal is to determine:

- The total number of possible outcomes when selecting 2 coins at random.
- The probability of each type of outcome (e.g., both coins being quarters, one quarter and one dime, etc.).
- The expected value of the sum of the two coins selected.
- The possible scenarios and their likelihoods.

Total Number of Ways to Pick 2 Coins

When choosing 2 coins at random from 10 without replacement, the total number of combinations is calculated using the combination formula:

$$ C(n, k) = \frac{n!}{k!(n - k)!} $$

where:

- n is the total number of items (coins, in this case),
- k is the number of items to choose.

Applying this:

$$ C(10, 2) = \frac{10!}{2!(10-2)!} = \frac{10 \times 9}{2 \times 1} = 45 $$

So, there are 45 possible outcomes when selecting any 2 coins at random from Ricky’s collection.

Possible Types of Coin Pairs

Next, we categorize the possible pairs based on the types of coins selected:

- Both coins are quarters
- Both coins are dimes
- Both coins are nickels
- One quarter and one dime
- One quarter and one nickel
- One dime and one nickel

These categories are mutually exclusive and cover all possible combinations.

Calculating the Number of Favorable Outcomes for Each Category

To find the probability of each category, we need to determine the number of favorable outcomes for each case (i.e., the number of ways to pick such pairs).

1. Both Quarters

Number of ways to choose 2 quarters from 3:

$$ C(3, 2) = \frac{3!}{2!(3-2)!} = 3 $$

2. Both Dimes

Number of ways to choose 2 dimes from 5:

$$ C(5, 2) = \frac{5!}{2!(5-2)!} = 10 $$

3. Both Nickels

Number of ways to choose 2 nickels from 2:

$$ C(2, 2) = 1 $$

4. One Quarter and One Dime

Number of ways to choose 1 quarter from 3 and 1 dime from 5:

$$ C(3, 1) \times C(5, 1) = 3 \times 5 = 15 $$

5. One Quarter and One Nickel

Number of ways to choose 1 quarter from 3 and 1 nickel from 2:

$$ C(3, 1) \times C(2, 1) = 3 \times 2 = 6 $$

6. One Dime and One Nickel

Number of ways to choose 1 dime from 5 and 1 nickel from 2:

$$ C(5, 1) \times C(2, 1) = 5 \times 2 = 10 $$

Summarizing the Outcomes

Category	Number of Ways	Total Possible Outcomes
Both Quarters	3	3
Both Dimes	10	10
Both Nickels	1	1
Quarter & Dime	15	15
Quarter & Nickel	6	6
Dime & Nickel	10	10
Total	—	45

This table confirms that the sum of all favorable outcomes equals the total possible combinations:

$$ 3 + 10 + 1 + 15 + 6 + 10 = 45 $$

which matches the total number of combinations.

Calculating Probabilities for Each Outcome

The probability of each category is the number of favorable outcomes divided by the total number of outcomes (45):

1. Both Quarters: $\frac{3}{45} = \frac{1}{15} \approx 6.67\%$
2. Both Dimes: $\frac{10}{45} = \frac{2}{9} \approx 22.22\%$
3. Both Nickels: $\frac{1}{45} \approx 2.22\%$
4. Quarter & Dime: $\frac{15}{45} = \frac{1}{3} \approx 33.33\%$
5. Quarter & Nickel: $\frac{6}{45} = \frac{2}{15} \approx 13.33\%$
6. Dime & Nickel: $\frac{10}{45} = \frac{2}{9} \approx 22.22\%$

These probabilities help us understand the likelihood of each type of coin pair being selected at random.

Calculating the Expected Value of the Sum of Selected Coins

Beyond just counting combinations, a common question is: What is the expected monetary value of the two coins Ricky picks?

Step 1: Assign values to each coin type

- Quarters: 25 cents
- Dimes: 10 cents
- Nickels: 5 cents

Step 2: Compute the sum for each combination

For each category, calculate the sum of the coin values:

Category	Number of Ways	Sample Pair	Sum of Values (in cents)
Both Quarters	3	(Q, Q)	25 + 25 = 50
Both Dimes	10	(D, D)	10 + 10 = 20
Both Nickels	1	(N, N)	5 + 5 = 10
Quarter & Dime	15	(Q, D)	25 + 10 = 35
Quarter & Nickel	6	(Q, N)	25 + 5 = 30
Dime & Nickel	10	(D, N)	10 + 5 = 15

Step 3: Calculate the expected value

The expected value (EV) is computed as:

\[
EV = \sum (\text{probability of category} \times \text{average sum in that category})
\]

Using the probabilities and sums:

\[
EV = \left(\frac{3}{45} \times 50\right) + \left(\frac{10}{45} \times 20\right) + \left(\frac{1}{45} \times 10\right) + \left(\frac{15}{45} \times 35\right) + \left(\frac{6}{45} \times 30\right) + \left(\frac{10}{45} \times 15\right)
\]

Calculating each term:

- \(\frac{3}{45} \times 50 = \frac{1}{15} \times 50 \approx 3.33 \)
- \(\frac{10}{45} \times 20 = \frac{2}{9} \times 20 \approx 4.44 \)
- \(\frac{1}{45} \times 10 \approx 0.22 \)
- \(\frac{15}{45} \times 35 = \frac{1}{3} \times 35 \approx 11.67 \)
- \(\frac{6}{45} \times 30 = \frac{2}{15} \times 30 = 4 \)
- \(\frac{

Frequently Asked Questions

What is the probability that Ricky takes exactly two quarters from his pocket containing 3 quarters, 5 dimes, and 2 nickels?

The probability is calculated by dividing the number of ways to choose 2 quarters out of 3 by the total number of ways to choose any 2 coins from all 10 coins. That is, (3C2) / (10C2) = 3 / 45 = 1/15.

What is the probability that Ricky picks one quarter and one dime from his pocket?

The probability is the number of ways to pick 1 quarter (3C1) and 1 dime (5C1) divided by the total number of 2-coin combinations: (3 5) / (10C2) = 15 / 45 = 1/3.

What is the probability that Ricky takes two nickels from his pocket?

The probability is the number of ways to choose 2 nickels out of 2 divided by total 2-coin combinations: (2C2) / (10C2) = 1 / 45.

What is the probability that Ricky picks two coins of the same denomination?

Total ways to pick same denomination coins: (3C2) for quarters + (5C2) for dimes + (2C2) for nickels = 3 + 10 + 1 = 14. Total 2-coin combinations are 45. So, probability = 14 / 45.

What is the probability that Ricky picks one quarter and one nickel from his pocket?

The probability is the number of ways to pick 1 quarter (3C1) and 1 nickel (2C1) divided by total combinations: (3 2) / 45 = 6 / 45 = 2 / 15.

Additional Resources

Ricky Takes 2 Coins At Random From 3 Quarters, 5 Dimes, And Two Nickels In His Pocket.1) What Is The Probability of Drawing Two Specific Coins? Exploring the Intricacies of Coin Selection and Probability

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Introduction

In everyday life, we often encounter situations that involve randomness and chance, from rolling dice to selecting cards or coins. One such intriguing scenario involves Ricky, who has a small collection of coins—specifically, three quarters, five dimes, and two nickels stored in his pocket. Without looking, he randomly picks two coins. The question arises: what is the probability of drawing certain combinations? For example, what is the likelihood that both coins are quarters? Or that he picks exactly one quarter and one dime? Understanding these probabilities not only enhances our grasp of basic combinatorial concepts but also provides insight into how chance operates in simple, real-world objects like coins.

In this article, we'll delve deeply into the problem of determining the probability of various outcomes when Ricky randomly selects two coins from his pocket. We will explore the fundamental principles of probability, apply combinatorial calculations, and interpret the results in a clear, reader-friendly manner.

Understanding the Composition of Ricky’s Coins

Before calculating probabilities, it's essential to understand the makeup of Ricky's coin collection:

- Quarters: 3 coins
- Dimes: 5 coins
- Nickels: 2 coins

Total coins in Ricky’s pocket: 3 + 5 + 2 = 10 coins

The diversity of coins introduces multiple possible combinations, making the calculation of probabilities a rich exercise in combinatorics.

The Basics of Probability and Combinatorics

Probability is a measure of how likely an event is to occur, expressed as a number between 0 (impossible) and 1 (certain). When dealing with discrete objects like coins, the probability of an event is typically calculated as:

$$ P(\text{event}) = \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}} $$

Combinatorics provides tools to count the number of ways objects can be combined or arranged. The key concepts here include:

- Combination ($\binom{n}{k}$): The number of ways to choose k items from n without regard to order.

For example, $\binom{10}{2}$ represents the total number of ways to pick any 2 coins from 10.

Calculating the Total Number of Outcomes

Since Ricky randomly picks two coins from ten, the total possible outcomes are all unordered pairs of coins:

$$ \text{Total outcomes} = \binom{10}{2} $$

Calculating:

$$ \binom{10}{2} = \frac{10 \times 9}{2} = 45 $$

Thus, there are 45 different possible pairs Ricky could select.

Classifying Favorable Outcomes

Depending on the specific event we are interested in (e.g., both coins are quarters, one quarter and one dime, etc.), the number of favorable outcomes varies. To systematically analyze these, we consider:

- Event A: Both coins are quarters.
- Event B: One quarter and one dime.
- Event C: One nickel and one dime.
- Event D: Any two coins (the total, as a baseline).
- Event E: Two nickels.

Let's explore each case.

Drawing Two Quarters (Event A)

Number of favorable outcomes:

- The number of ways to choose 2 quarters from 3:

$$
\binom{3}{2} = \frac{3 \times 2}{2} = 3
$$

Probability:

$$
P(\text{both coins are quarters}) = \frac{\text{favorable outcomes}}{\text{total outcomes}} = \frac{3}{45} = \frac{1}{15} \approx 0.0667
$$

Interpretation:

There is approximately a 6.67% chance that Ricky randomly selects two quarters from his collection.

Drawing One Quarter and One Dime (Event B)

Number of favorable outcomes:

- Number of ways to pick 1 quarter out of 3:

$$
\binom{3}{1} = 3
$$

- Number of ways to pick 1 dime out of 5:

$$
\binom{5}{1} = 5
$$

- Since the draws are unordered pairs, total favorable outcomes:

$$
\text{Favorable outcomes} = \binom{3}{1} \times \binom{5}{1} = 3 \times 5 = 15
$$

Probability:

$$
P(\text{one quarter and one dime}) = \frac{15}{45} = \frac{1}{3} \approx 0.3333
$$

Interpretation:

There is about a 33.33% chance Ricky picks one quarter and one dime.

Drawing One Nickel and One Dime (Event C)

Number of favorable outcomes:

- Ways to choose 1 nickel:

$$
\binom{2}{1} = 2
$$

- Ways to choose 1 dime:

$$
\binom{5}{1} = 5
$$

- Total favorable outcomes:

\[

$$
2 \times 5 = 10
$$

Probability:

$$
P(\text{one nickel and one dime}) = \frac{10}{45} = \frac{2}{9} \approx 0.2222
$$

Interpretation:

Approximately 22.22% chance of selecting one nickel and one dime.

Drawing Two Nickels (Event D)

Number of favorable outcomes:

$$
\binom{2}{2} = 1
$$

Probability:

$$
P(\text{both coins are nickels}) = \frac{1}{45} \approx 0.0222
$$

Interpretation:

A small 2.22% chance of drawing both nickels.

Drawing Any Two Coins (Event E)

This is the total possible outcomes, which we already calculated:

$$
\binom{10}{2} = 45
$$

This serves as the denominator for all probabilities.

Extending the Analysis: Additional Scenarios

Beyond these basic combinations, we might be interested in more complex scenarios, such as:

- Drawing two coins of the same denomination.
- Drawing one coin of each denomination (quarter, dime, nickel) in two picks.
- The probability that Ricky picks at least one quarter.

Let's explore these briefly.

Probability of Drawing Two Coins of the Same Denomination

Quarters:

$$
\binom{3}{2} = 3
$$

Dimes:

$$
\binom{5}{2} = \frac{5 \times 4}{2} = 10
$$

Nickels:

$$
\binom{2}{2} = 1
$$

Total same-denomination outcomes:

$$
3 + 10 + 1 = 14
$$

Probability:

$$
P(\text{both coins same denomination}) = \frac{14}{45} \approx 0.3111
$$

Interpretation:

There is roughly a 31.11% chance Ricky picks two coins of the same type.

Probability of Drawing At Least One Quarter

Method:

It’s often easier to compute the complement: the probability of drawing no quarters, then subtract from 1.

- Number of coins that are not quarters:

$$
5 \text{ dimes} + 2 \text{ nickels} = 7
$$

- Number of ways to select 2 coins with no quarters:

$$
\binom{7}{2} = \frac{7 \times 6}{2} = 21
$$

- Probability of no quarters:

$$
\frac{21}{45} = \frac{7}{15} \approx 0.4667
$$

- Therefore, probability of at least one quarter:

$$
1 - \frac{7}{15} = \frac{8}{15} \approx 0.5333
$$

Interpretation:

There is approximately a 53.33% chance Ricky picks at least one quarter.

Real-World Implications and Broader Context

While these calculations may seem abstract, they mirror real-world situations where understanding probability is crucial—be it in gambling, decision-making, or statistical analysis. For example:

- Financial Decisions: Knowing the chance of drawing certain coins can help in understanding expected values.
- Game Design: Designing games involving chance can rely on similar probability calculations.
- Educational Purposes: These exercises serve as excellent tools to teach fundamental concepts in probability and combinatorics.

Furthermore, this problem exemplifies how simple objects like coins can be used to illustrate core principles of probability, making abstract concepts more tangible and accessible.

Conclusion

Ricky's coin selection scenario offers a fascinating glimpse into the application of combinatorial probability. By systematically analyzing the various possible outcomes and calculating their probabilities, we gain a clearer understanding of chance and how it operates within simple systems. Whether Ricky is hoping to draw two quarters or trying to understand his odds of selecting specific coin combinations, the principles outlined here provide a foundational framework for approaching similar problems.

In summary:

- The total number

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