# A Bin Contains Seven Red Chips, Nine Green Chips, Three Yellow Chips, And Six Blue Chips. Find The Probability

**A Bin Contains Seven Red Chips, Nine Green Chips, Three Yellow Chips, And Six Blue Chips. Find The Probability**

Determining probabilities in a scenario involving multiple types of chips within a bin is a fundamental concept in probability theory. Whether you're a student preparing for exams or someone interested in understanding real-world applications of probability, analyzing such problems helps develop critical thinking skills. In this article, we'll explore how to compute the probability of drawing specific chips from a bin that contains a mixture of different colored chips, with a focus on clear, step-by-step explanations.

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## Understanding the Problem

At the core of probability problems involving a mixture of items lies the concept of sample space—the total set of possible outcomes—and event space—the subset of outcomes we're interested in.

In our case, the bin contains:
- 7 Red chips
- 9 Green chips
- 3 Yellow chips
- 6 Blue chips

Total number of chips in the bin:

$$
\text{Total chips} = 7 + 9 + 3 + 6 = 25
$$

The primary question is: What is the probability of drawing a specific type of chip or a particular combination of chips? For example:
- The probability of drawing a red chip
- The probability of drawing a green or yellow chip
- The probability of drawing a blue chip first and a yellow chip second, without replacement

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# Basic Concepts in Probability

Before diving into calculations, let's review some key concepts:

## 1. Sample Space

The set of all possible outcomes. For a single draw, the sample space includes all 25 chips.

## 2. Event

A subset of the sample space. For example, drawing a red chip is an event.

## 3. Probability of an Event

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

## 4. Probability of Multiple Events

- Independent events: The outcome of one does not affect the other.
- Dependent events: The outcome of one affects the probability of the next (e.g., drawing without replacement).

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# Calculating Basic Probabilities

Let's consider some straightforward probability calculations based on the given data.

## Probability of Drawing a Red Chip

Number of red chips: 7

Total chips: 25

\[

$$
P(\text{Red}) = \frac{7}{25}
$$

## Probability of Drawing a Green Chip

Number of green chips: 9

$$
P(\text{Green}) = \frac{9}{25}
$$

## Probability of Drawing a Yellow Chip

Number of yellow chips: 3

$$
P(\text{Yellow}) = \frac{3}{25}
$$

## Probability of Drawing a Blue Chip

Number of blue chips: 6

$$
P(\text{Blue}) = \frac{6}{25}
$$

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# Calculating Combined Probabilities

What if we want to find the probability of drawing certain combinations? Let's explore some scenarios.

## 1. Probability of Drawing a Red or Green Chip

Since these are mutually exclusive events (can't be both at the same time):

$$
P(\text{Red or Green}) = P(\text{Red}) + P(\text{Green}) = \frac{7}{25} + \frac{9}{25} = \frac{16}{25}
$$

\]

## 2. Probability of Drawing a Yellow Chip or a Blue Chip

Similarly,

\[
P(\text{Yellow or Blue}) = \frac{3}{25} + \frac{6}{25} = \frac{9}{25}
\]

## 3. Probability of Drawing a Red and then a Green Chip (Without Replacement)

Since the chips are drawn without replacement, the probabilities change after the first draw.

- Probability of drawing a red chip first:

\[
P(\text{Red first}) = \frac{7}{25}
\]

- After removing one red chip, remaining chips:

\[
25 - 1 = 24
\]
- Remaining green chips: 9 (unchanged)

- Probability of drawing a green chip second:

\[
P(\text{Green second} | \text{Red first}) = \frac{9}{24} = \frac{3}{8}
\]

- Combined probability:

\[
P(\text{Red then Green}) = P(\text{Red first}) \times P(\text{Green second} | \text{Red first}) = \frac{7}{25} \times \frac{3}{8} = \frac{21}{200}
\]

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# Advanced Scenarios and Calculations

Now, let's consider more complex probability scenarios involving multiple draws, special conditions, or multiple chips.

## 1. Probability of Drawing Two Chips of the Same Color in Two Draws (Without Replacement)

Let's analyze the probability of drawing two red chips in succession.

- First draw:

$$
P(\text{Red first}) = \frac{7}{25}
$$

- Second draw (given the first was red):

Remaining red chips: 6

Remaining total chips: 24

$$
P(\text{Red second} | \text{Red first}) = \frac{6}{24} = \frac{1}{4}
$$

- Overall probability:

$$
P(\text{Two reds}) = \frac{7}{25} \times \frac{6}{24} = \frac{7}{25} \times \frac{1}{4} = \frac{7}{100}
$$

Similarly, for two green chips:

$$
P(\text{Two greens}) = \frac{9}{25} \times \frac{8}{24} = \frac{9}{25} \times \frac{1}{3} = \frac{3}{25}
$$

## 2. Probability of Drawing One Yellow and One Blue Chip in Two Draws

Assuming order doesn't matter, the probability of drawing one yellow and one blue in any order.

- First, Yellow then Blue:

$$
P(\text{Yellow then Blue}) = \frac{3}{25} \times \frac{6}{24} = \frac{3}{25} \times \frac{1}{4} = \frac{3}{100}
$$

- Second, Blue then Yellow:

$$
P(\text{Blue then Yellow}) = \frac{6}{25} \times \frac{3}{24} = \frac{6}{25} \times \frac{1}{8} = \frac{6}{200} = \frac{3}{100}
$$

- Total probability (either order):

$$
P(\text{Yellow and Blue in any order}) = \frac{3}{100} + \frac{3}{100} = \frac{6}{100} = \frac{3}{50}
$$

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# Applications in Real Life

Understanding how to compute probabilities in such scenarios has practical applications:

- Gambling and Casinos: Calculating chances of drawing specific cards or chips.
- Quality Control: Determining probabilities of defective items in a batch.
- Inventory Management: Estimating chances of selecting items of certain types.
- Educational Testing: Analyzing probabilities in multiple-choice scenarios.

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# Summary and Key Takeaways

- The total number of chips in the bin is 25.

- Probabilities are calculated as the ratio of favorable outcomes to total outcomes.
- For multiple draws, especially without replacement, probabilities are dependent and require adjusting the total and favorable counts after each draw.
- Combining probabilities involves addition (for mutually exclusive events) or multiplication (for independent or sequential events).

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## Conclusion

Calculating probabilities in a mixture of different items, such as chips of various colors, involves understanding basic probability principles and applying appropriate formulas based on whether draws are with or without replacement. By breaking down problems into manageable steps, you can accurately determine the likelihood of various events. Whether for academic purposes or practical applications, mastering these concepts enhances your ability to analyze complex probability scenarios confidently.

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## Practice Problems

Try calculating the following:

1. What is the probability of drawing a yellow chip first and a blue chip second, without replacement?
2. What is the probability of drawing at least one red chip in two draws?
3. If you draw three chips without replacement, what is the probability that all three are of different colors?

Answers and explanations can be explored to deepen your understanding of probability calculations.

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Remember: Mastery of probability involves practice and understanding the underlying concepts. Use these calculations as a foundation to analyze more complex scenarios and develop your skills further.

## Frequently Asked Questions

## What is the total number of chips in the bin?

The total number of chips is 7 Red + 9 Green + 3 Yellow + 6 Blue = 25 chips.

## What is the probability of drawing a red chip from the bin?

The probability of drawing a red chip is 7/25.

## What is the probability of drawing a green chip from the bin?

The probability of drawing a green chip is 9/25.

## What is the probability of drawing a yellow chip from the bin?

The probability of drawing a yellow chip is 3/25.

## What is the probability of drawing a blue chip from the bin?

The probability of drawing a blue chip is 6/25.

## If one chip is drawn at random, what is the probability that it is not yellow?

The probability that the chip is not yellow is (25 - 3) / 25 = 22/25.

## What is the probability of drawing either a red or a green chip?

The probability is (7 + 9) / 25 = 16/25.

## If two chips are drawn without replacement, what is the probability both are blue?

The probability is (6/25) (5/24) = 30/600 = 1/20.

## What is the probability of drawing a yellow chip or a blue chip in a single draw?

The probability is (3 + 6) / 25 = 9/25.

# Additional Resources

Probability is a fundamental concept in mathematics and statistics that quantifies the likelihood of an event occurring. It provides a measure, ranging from 0 to 1, indicating how probable an event is—where 0 signifies impossibility and 1 signifies certainty. In real-world applications, understanding probability helps in decision-making under uncertainty, risk assessment, game theory, and various scientific analyses.

In this detailed discussion, we will explore the probability associated with drawing chips of certain colors from a bin containing a mix of different colored chips. The problem statement is as follows:

A bin contains seven red chips, nine green chips, three yellow chips, and six blue chips. Find the probability...

To thoroughly understand and compute the probability in this context, we will break down the problem into several sections, covering fundamental concepts, the specifics of the given problem, step-by-step calculation, and extended discussions about related probability topics.

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# Understanding the Composition of the Bin

Before diving into probability calculations, it's essential to understand what the bin contains, as this directly influences the probability outcomes.

## Details of the Chips in the Bin

- Red Chips: 7
- Green Chips: 9
- Yellow Chips: 3
- Blue Chips: 6

Total number of chips in the bin:

$$\text{Total} = 7 + 9 + 3 + 6 = 25$$

This total is crucial because probability is always computed relative to the total number of possible outcomes—in this case, the total chips.

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# Core Principles of Probability

## Basic Probability Formula

The probability $P(E)$ of an event $E$ occurring is given by:

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

In the context of drawing chips:

- Favorable outcomes: The chips of a particular color or satisfying a certain condition.
- Total outcomes: The total chips present in the bin.

## Assumptions in the Problem

- The chips are well mixed, ensuring each chip has an equal chance of being drawn.
- The drawing is random and without replacement or with replacement, depending on the specific event considered (this should be clarified in the problem). In most standard probability problems involving drawing chips, unless specified, the assumption is often without replacement, meaning after a chip is drawn, it isn't returned.

For this problem, unless specified otherwise, we will assume the drawing is without replacement because it's the common scenario.

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# Types of Probability Events in the Context of the Problem

Depending on what the question asks, various types of events can be considered:

- Drawing a chip of a specific color.
- Drawing a chip that is not of a certain color.
- Drawing a chip of a particular color in multiple draws.
- Drawing multiple specific colors in sequence.
- Probabilities involving multiple events (compound events).

For the scope of this discussion, the most common and straightforward question is: "What is the probability of drawing a chip of a particular color?"

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# Calculating Basic Probabilities for Single Draws

Let's explore the probability of drawing a chip of each color, which forms the foundation for understanding more complex scenarios.

## Probability of Drawing a Red Chip (P(Red))

Number of red chips = 7

Total chips = 25

$$
P(\text{Red}) = \frac{7}{25} = 0.28
$$

This indicates a 28% chance of drawing a red chip in a single, random draw.

## Probability of Drawing a Green Chip (P(Green))

Number of green chips = 9

$$
P(\text{Green}) = \frac{9}{25} = 0.36
$$

A 36% chance for green.

## Probability of Drawing a Yellow Chip (P(Yellow))

Number of yellow chips = 3

$$
P(\text{Yellow}) = \frac{3}{25} = 0.12
$$

A 12% chance for yellow.

### Probability of Drawing a Blue Chip (P(Blue))

Number of blue chips = 6

$$
P(\text{Blue}) = \frac{6}{25} = 0.24
$$

A 24% chance for blue.

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## Calculating Probabilities for Specific Events

Beyond single-color probabilities, the problem can extend to more complex events.

### Event 1: Drawing a Red or Green Chip

Since these events are mutually exclusive (a chip can't be both red and green simultaneously), the probability of drawing either a red or green chip is:

$$
P(\text{Red or Green}) = P(\text{Red}) + P(\text{Green}) = \frac{7}{25} + \frac{9}{25} = \frac{16}{25} = 0.64
$$

Thus, there's a 64% chance to draw either a red or green chip.

### Event 2: Drawing a Yellow or Blue Chip

Similarly:

$$
P(\text{Yellow or Blue}) = \frac{3}{25} + \frac{6}{25} = \frac{9}{25} = 0.36
$$

36% chance.

### Event 3: Drawing a Non-Red Chip

Complementary probability:

$$
P(\text{Not Red}) = 1 - P(\text{Red}) = 1 - \frac{7}{25} = \frac{18}{25} = 0.72
$$

72% chance.

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## Multiple Draw Scenarios and Conditional Probabilities

In many cases, questions involve multiple draws, which introduce conditional probability considerations.

### Example: Probability of Drawing a Red Chip First, then a Green Chip (Without Replacement)

Assuming the first draw is red:

- Probability of first red:

$$
P(\text{Red}_1) = \frac{7}{25}
$$

- After removing one red chip, remaining chips:

$$
25 - 1 = 24
$$

- Number of green chips remains 9 (since no green was drawn):

- Probability of then drawing a green:

$$
P(\text{Green}_2 | \text{Red}_1) = \frac{9}{24} = \frac{3}{8}
$$

- Overall probability:

$$
P(\text{Red}_1 \text{ and then Green}_2) = P(\text{Red}_1) \times P(\text{Green}_2 | \text{Red}_1) = \frac{7}{25} \times \frac{9}{24} = \frac{7 \times 9}{25 \times 24} = \frac{63}{600} = \frac{21}{200} = 0.105
$$

This indicates a 10.5% chance of drawing a red chip first and then a green chip.

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# Probability of Specific Colors in Multiple Draws

Calculating the probability that multiple specific conditions occur in sequence involves understanding permutations, combinations, and the concept of probability trees.

Example: What is the probability that in two consecutive draws (without replacement), the first chip is yellow and the second is blue?

- First draw (yellow):

$$
P(\text{Yellow}_1) = \frac{3}{25}
$$

- After drawing yellow:

Remaining chips:

$$
25 - 1 = 24
$$

- Second draw (blue):

$$
P(\text{Blue}_2 | \text{Yellow}_1) = \frac{6}{24} = \frac{1}{4}
$$

- Overall probability:

$$
\frac{3}{25} \times \frac{6}{24} = \frac{3 \times 6}{25 \times 24} = \frac{18}{600} = \frac{3}{100} = 0.03
$$

A 3% chance.

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# Extensions and Advanced Probability Concepts

While basic probability calculations are straightforward, more advanced concepts can be introduced to deepen understanding.

## Conditional Probability

- The probability of an event occurring given that another event has already occurred.
- Expressed as:

$$
P(A | B) = \frac{P(A \cap B)}{P(B)}
$$

- Useful in multi-event scenarios, such as the previous example.

Bayes' Theorem

- Connects conditional probabilities of events:

\[
P(A | B) = \frac{P(B | A) \times P(A)}{P(B)}
\]

- Essential for updating probabilities based on new evidence.

## Complementary Events

- The probability that an event does not occur:

\[
P(\text{not } E) = 1 - P(E)
\]

- Useful for calculating the likelihood of the opposite of a particular outcome.

## Probability Distributions

- In some scenarios, the number of successes follows a binomial distribution.
- For example, the probability of drawing a certain number of

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