One Of The 120 People Are Chosen At Random.Work Out The Probability That This Person Is A Mole Who Wanted

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In everyday life, understanding probabilities can help us make better decisions, assess risks, and understand the likelihood of various events. A common scenario involves selecting individuals at random from a group and determining the probability that a specific trait or characteristic is present. For example, if you have a group of 120 people and want to find the probability that a randomly selected person is a mole who wanted something, it's essential to understand how probability works and how to calculate it accurately.

This article aims to explore this particular problem in detail, providing a comprehensive understanding of probability concepts, how to formulate such problems, and how to approach calculating the probability that a randomly chosen individual from a group possesses a specific characteristic—in this case, being a "mole who wanted." We will break down the problem step by step, discuss relevant probability principles, and provide practical examples to clarify the process.

Understanding the Problem Statement

Before diving into calculations, it’s crucial to interpret the problem clearly:

- Total number of people: 120
- Selection method: Random, meaning each person has an equal chance of being chosen.
- Event of interest: The selected person is a "mole who wanted" (assuming "mole" and "wanted" are characteristics or traits).

The core question is: What is the probability that, when one person is selected at random from the group of 120, this person is a mole who wanted?

Clarifying Key Terms and Assumptions

To accurately compute the probability, we need to understand what "mole" and "wanted" mean in this context:

- Mole: Could refer to a spy infiltrating a group, or metaphorically, someone with a hidden agenda.
- Wanted: Could imply that the person has a specific desire or intent.

Since the problem is somewhat abstract, we will make some assumptions to proceed:

1. Independence: The characteristics "mole" and "wanted" are independent unless specified otherwise.
2. Prevalence: The proportion of moles in the group and the proportion of people who wanted something.
3. Combined event: The person is both a mole and wanted.

If the problem provides specific numbers or probabilities for these traits, we could incorporate them directly. Since these are not provided, we will consider a general framework and hypothetical probabilities.

Approach to Calculating the Probability

Calculating the probability that a randomly selected person is a "mole who wanted" involves understanding the joint probability of two events:

- Event A: The person is a mole.
- Event B: The person wanted something.

The probability we're looking for is:

$$ P(\text{Mole and Wanted}) = P(\text{Mole}) \times P(\text{Wanted} | \text{Mole}) $$

if the events are independent, or

$$ P(\text{Mole and Wanted}) = P(\text{Wanted}) \times P(\text{Mole} | \text{Wanted}) $$

if the probability of being a mole depends on wanting something.

Note: If the data indicates dependence, we need the conditional probabilities.

Hypothetical Data and Calculations

Let's suppose the following for illustration:

- Number of moles in the group: 12 (i.e., 10% of the group)
- Number of people who wanted something: 60 (i.e., 50% of the group)
- Number of moles who wanted: 6 (i.e., 50% of moles)

Given these, we can derive:

- $P(\text{Mole}) = \frac{12}{120} = 0.1$
- $P(\text{Wanted}) = \frac{60}{120} = 0.5$
- $P(\text{Mole and Wanted}) = \frac{6}{120} = 0.05$

Therefore:

$$ P(\text{Mole and Wanted}) = 0.05 $$

This indicates that there's a 5% chance that a randomly selected individual is both a mole who wanted.

Calculating the Probability in Practice

Based on the above data, the probability that a randomly selected person from the group is a mole who wanted is 5% or 0.05.

In words:

- If you randomly pick one person from the group, there’s a 5% chance they are both a mole and wanted something.

Understanding and Interpreting the Result

This probability can be interpreted in several ways:

- Risk assessment: If you wanted to avoid selecting a mole who wanted, the probability is 95%.
- Decision-making: If you are trying to identify such individuals, knowing this probability helps estimate how many people to screen.
- Probability distribution: Understanding the distribution helps in planning security measures or investigative strategies.

Factors Affecting the Probability

Several factors can influence the probability calculation:

- Prevalence of moles: Higher or lower numbers of moles affect P(Mole).
- Desire to wanted: Varies based on context.
- Dependence of traits: If being a mole and wanting are related, the calculation must account for conditional probabilities.
- Sample size and randomness: Ensuring the selection process is truly random is crucial for the validity of the probability estimate.

Real-World Applications of Such Probability

Calculations

Understanding how to work out probabilities like this has practical applications:

- Security and espionage: Estimating the likelihood of infiltrators in an organization.
- Epidemiology: Calculating the probability of individuals having multiple risk factors.
- Market research: Determining the chance of customers having certain preferences.
- Quality control: Assessing the probability of defective items with multiple defect characteristics.

Conclusion

Calculating the probability that a randomly selected individual from a group of 120 people is a "mole who wanted" involves understanding the basic principles of probability, defining the traits clearly, and using relevant data to estimate joint probabilities. By breaking down the problem into manageable parts—identifying the individual probabilities, understanding whether the events are independent or dependent, and applying the multiplication rule—we can arrive at a meaningful estimate.

In our hypothetical example, we found a 5% chance, but in real situations, accurate data collection and understanding the context are essential. Whether for security, research, or decision-making, mastering probability calculations enables us to make informed predictions and better understand the likelihood of complex events.

Further Reading and Resources

- Probability and Statistics for Engineering and the Sciences by Jay L. Devore
- Introduction to Probability by Joseph K. Blitzstein and Jessica Hwang
- Online calculators and tools for probability computations
- Articles on Bayesian probability for dependent events

By applying these principles and methods, you can confidently analyze similar problems involving multiple traits or characteristics and their associated probabilities.

Frequently Asked Questions

What is the probability that the randomly chosen person is a mole who wanted?

The probability depends on the total number of moles who wanted among the 120 people. If the number of such moles is M, then the probability is M divided by 120.

How do I calculate the probability of selecting a mole who wanted from a group of 120 people?

Identify the total number of moles who wanted (M) in the group. Then, divide M by 120 to find the probability: P = M/120.

If I know there are 15 moles who wanted among the 120 people, what is the probability of selecting one?

The probability is 15 divided by 120, which simplifies to 1/8 or 0.125.

Can the probability be 1 if all 120 people are moles who wanted?

Yes, if all 120 people are moles who wanted, then the probability of choosing one is 120/120 = 1.

What assumptions are made when calculating this probability?

It is assumed that each person is equally likely to be chosen at random and that the total number of moles who wanted is known or estimated accurately.

How does the probability change if there are fewer moles who wanted?

The probability decreases proportionally. Fewer moles who wanted means a smaller ratio M/120, reducing the likelihood of selecting one.

Is it possible to determine the probability without knowing how many moles wanted?

No, without knowing the number of moles who wanted (M), you cannot accurately calculate the probability.

What is the significance of the probability value in this context?

It indicates the likelihood of randomly selecting a person who is a mole who wanted among the 120 people, helping assess risk or prevalence.

If the probability is very low, what does that imply

about the number of moles who wanted?

It implies that the number of moles who wanted (M) is small relative to the total, making such a person less likely to be chosen at random.

Additional Resources

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Introduction

In the realm of probability and statistical analysis, scenarios involving random selections from a finite population are commonplace. They serve as fundamental examples to understand concepts like likelihood, randomness, and conditional probability. Today, we examine a particularly intriguing case: among a group of 120 individuals, one is randomly chosen. The question posed is: what is the probability that this person is a mole who wanted? Although the phrase "who wanted" appears incomplete, it suggests a context of intent or motive, possibly implying that the mole's motivation is known or should be considered in the probability calculation.

This article aims to dissect this problem thoroughly, exploring the assumptions, mathematical formulations, and implications involved. We will analyze the problem's structure, interpret ambiguous elements, and ultimately derive a well-founded probability estimate. The discussion will encompass fundamental probability principles, assumptions relevant to the scenario, and potential extensions or complexities that could influence the calculation.

Understanding the Scenario: Breaking Down the Problem

The Population and Random Selection

The core of the problem involves a population of 120 individuals, from which a single person is chosen at random. Assuming each individual has an equal chance of being selected, the probability of selecting any particular individual is:

$$
P(\text{selecting any one person}) = \frac{1}{120}
$$

This forms the basis of uniform probability distribution over the finite set of people. The key question is, within this population, how many are "moles who wanted," and what is the probability that the chosen individual falls into this subgroup?

Clarifying "Mole Who Wanted"

The phrase "mole who wanted" appears incomplete or potentially ambiguous. In the context of probability puzzles, "mole" often refers to an infiltrator or spy within a group. The phrase "who wanted" might imply:

- The mole has a specific desire or goal (e.g., to sabotage, to gather

information).
- The focus is on the motive or intention of the mole, possibly linked with their identity.

For clarity, we will interpret the problem as asking:

"Given that there are certain individuals identified as moles within the population, what is the probability that a randomly selected person is a mole?"

If the phrase "who wanted" is meant to specify the mole's motivation, then perhaps the question extends to the likelihood that the selected mole shared a particular desire.

Assumptions and Data Needed

To proceed with a quantitative analysis, we need to establish some assumptions:

1. Number of Moles in the Population:
How many individuals are identified or suspected as moles? For example, suppose there are M moles within the 120 individuals.

2. Probability of Selection:
Since selection is random, each individual has an equal chance, regardless of their role.

3. Motivational Data:
If the question involves the mole's desire or intent, do we have data on how many moles wanted a particular outcome? For example, if only some moles "wanted" a specific thing, this affects the probability.

4. Independence of Events:
The selection process is independent, and the role or motivation of individuals does not influence the selection probability directly.

Mathematical Framework

Assuming the key data points are:

- Total population, $N = 120$
- Number of moles, $M \leq 120$
- Number of moles who wanted a specific outcome, W

The probability that a randomly selected person is a mole who wanted that outcome is then:

$$
P = \frac{\text{Number of moles who wanted}}{\text{Total population}} = \frac{W}{120}
$$

Similarly, if the goal is to find the probability that the selected person is a mole who wanted given that they are a mole, the conditional probability is:

$$
P(\text{wanted} \mid \text{mole}) = \frac{W}{M}
$$

And, the joint probability that a randomly selected person is a mole who wanted is:

$$
P(\text{mole and wanted}) = P(\text{mole}) \times P(\text{wanted} \mid \text{mole}) = \frac{M}{120} \times \frac{W}{M} = \frac{W}{120}
$$

Thus, the probability hinges on the number of moles who wanted.

Exploring Different Scenarios

Scenario 1: All Moles Wanted

Suppose all moles wanted the goal, i.e., $W = M$. Then the probability becomes:

$$
P = \frac{M}{120}
$$

If, for example, there are 12 moles:

$$
P = \frac{12}{120} = \frac{1}{10} = 0.1
$$

This indicates a 10% chance that a randomly selected person is a mole who wanted.

Scenario 2: Some Moles Wanted, Others Did Not

Suppose only a subset of the moles had the wanted motive. For instance, if:

- Total moles, $M = 15$
- Moles who wanted, $W = 5$

Then,

$$
P = \frac{W}{120} = \frac{5}{120} = \frac{1}{24} \approx 0.0417
$$

This reflects approximately a 4.17% chance.

Scenario 3: Unknown Number of Moles and Wanted Moles

In many real-world situations, the exact numbers are unknown. In such cases, probability estimates rely on Bayesian inference or assumptions based on prior knowledge.

Incorporating the "Wanted" Aspect: Motivational Probability

If the question aims to incorporate the likelihood that the chosen mole "wanted" something specific, perhaps related to their role, then the analysis involves conditional probabilities.

Suppose:

- The probability that a randomly chosen individual is a mole: $P(\text{mole}) = \frac{M}{120}$
- The probability that a mole "wanted" something: $P(\text{wanted} \mid \text{mole})$

Then, the probability that the selected individual is a mole who wanted is:

$$
P(\text{mole and wanted}) = P(\text{mole}) \times P(\text{wanted} \mid \text{mole})
$$

This product depends on the known or estimated values of M and $P(\text{wanted} \mid \text{mole})$.

Dealing with Incomplete or Ambiguous Data

In many real-world problems, data regarding the number of moles and their motives might not be explicit. In such cases, probabilities are estimated based on:

- Historical or intelligence data
- Probabilistic models
- Expert judgment

For example, if intelligence suggests that roughly 10% of the population are moles, and among them, about 50% wanted a particular outcome, then:

$$
P = \frac{M}{120} \times P(\text{wanted} \mid \text{mole}) = 0.1 \times 0.5 = 0.05
$$

Thus, there is a 5% chance that a randomly selected individual is a mole who wanted the specific goal.

The Role of Bayesian Updating

If initial assumptions are uncertain, Bayesian methods can refine probability estimates based on observed data or additional information. For example, if new intelligence suggests a higher or lower number of moles or their motives, the probability can be updated accordingly.

Bayes' theorem states:

\[
P(\text{mole} \mid \text{wanted}) = \frac{P(\text{wanted} \mid \text{mole})

\times P(\text{mole})}{P(\text{wanted})}
\]

where:

\[
P(\text{wanted}) = P(\text{wanted} \mid \text{mole}) \times P(\text{mole}) + P(\text{wanted} \mid \text{not mole}) \times P(\text{not mole})
\]

This approach allows for a nuanced understanding, especially when considering the likelihood of motives among non-moles.

Conclusion: Final Probabilistic Insights

The probability that a randomly selected person from a group of 120 is a mole who wanted depends critically on:

- The number of moles in the population
- The number of moles who had the wanted motive
- The assumptions about uniform randomness and independence

In the simplest case, where all moles wanted what they wanted and their number is known, the probability can be directly computed as \(\frac{W}{120} \).

In more complex or uncertain scenarios, Bayesian inference or estimations based on intelligence and prior data are necessary.

Key takeaways:

- Without specific data, the best estimate involves assumptions about the proportion of moles and their motives.
- The problem exemplifies fundamental probability principles, including joint and conditional probabilities.
- The context of motives adds a layer of complexity, requiring probabilistic modeling and potentially Bayesian updating.

Final Remarks

Understanding probabilities in scenarios involving hidden roles or motives, like the case of moles, underscores the importance of data and assumptions. Whether in intelligence analysis, statistical modeling, or everyday decision-making, such frameworks facilitate informed judgments amid uncertainty. The question "Work out

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