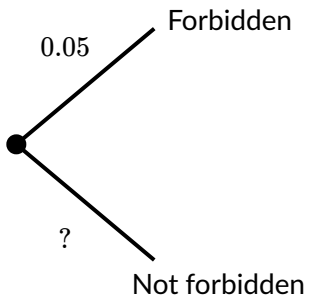
Starting a tree diagram

The chance that the alarm is triggered depends on whether or not the bag contains a forbidden item, so we should first distinguish between bags that contain a forbidden item and those that don't.

> "Suppose that 5% of bags contain forbidden items."



QUESTION 1

What is the probability that a randomly chosen bag does NOT contain a forbidden item?

$P(\text{not forbidden}) =$ 0.95

Check

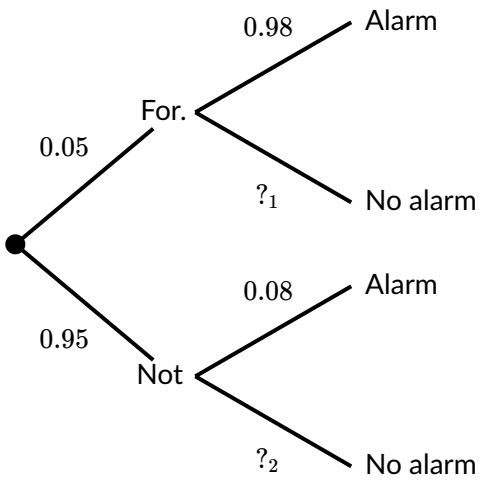
Explain

Filling in the tree diagram

> "If a bag contains a forbidden item, there is a 98% chance that it triggers the alarm."

"If a bag doesn't contain a forbidden item, there is an 8% chance that it triggers the alarm."

We can use these facts to fill in the next branches in the tree diagram like this:



QUESTION 2

Given that a bag contains a forbidden item, what is the probability that it does NOT trigger the alarm?

$?_1 =$ 0.02

Check

Explain

QUESTION 3

Given that a bag does NOT contain a forbidden item, what is the probability that is does NOT trigger the alarm?

$?_2 =$ 0.92

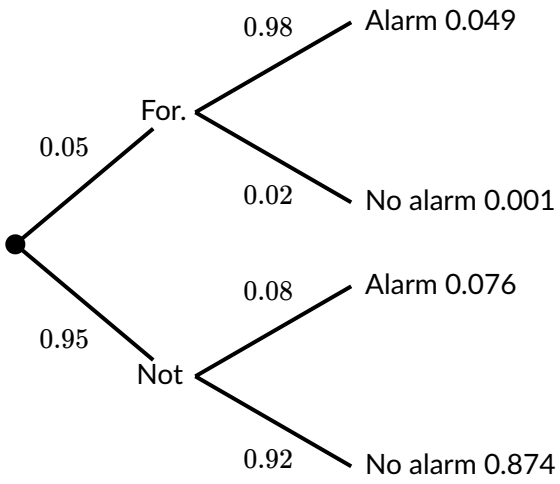
Check

Explain

Completing the tree diagram

We multiply the probabilities along the branches to complete the tree diagram.

Here's the completed diagram:



Solving the original problem

"Given a randomly chosen bag triggers the alarm, what is the probability that it contains a forbidden item?"

Use the probabilities from the tree diagram and the conditional probability formula:

$$P(\text{forbidden} \mid \text{alarm}) = \frac{P(\text{F} \cap \text{A})}{P(\text{A})}$$

[What do those symbols mean?]

QUESTION 4

Find the probability that a randomly selected bag contains a forbidden item AND triggers the alarm.

$P(\text{F} \cap \text{A}) =$ 0.049

Check

Explain

QUESTION 5

Find the probability that a randomly selected bag triggers the alarm.

$P(\text{A}) =$ 0.125

Check

Explain

QUESTION 6

Given a randomly chosen bag triggers the alarm, what is the probability that it contains a forbidden item?

Use three decimal places in your answer.

$P(\text{F}|\text{A}) =$ 0.392

Check

Explain

[Wait, why is that probability so low?]

Try one on your own!

A hospital is testing patients for a certain disease. If a patient has the disease, the test is designed to return a "positive" result. If a patient does not have the disease, the test should return a "negative" result. No test is perfect though.

- 99% of patients who have the disease will test positive.
- 5% of patients who don't have the disease will also test positive.
- 10% of the population in question has the disease.

If a random patient tests positive, what is the probability that they have the disease?

STEP 1

Find the probability that a randomly selected patient has the disease AND tests positive.

$P(\text{D} \cap +) =$ 0.099

Math › AP®/College Statistics › Probability › Conditional probability
Conditional probability

Conditional probability and independence
Conditional probability with Bayes' Theorem
Practice: Calculating conditional probability
Conditional probability using two-way tables
Conditional probability and independence
Conditional probability tree diagram example
Tree diagrams and conditional probability

Check

Explain

STEP 2

Find the probability that a random patient tests positive.

$P(+) =$ 0.144

Check

Explain

STEP 3

If a random patient tests positive, what is the probability that they have the disease?
Round to three decimal places.

$P(\text{D}|+) =$ 0.688

Check

Explain

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Questions Tips & Thanks

Want to join the conversation?