

That beetle!

An entomologist is excited because the markings on a beetle suggest it is from a rare subspecies that only makes up 0.1% of the population. 98% of the beetles in the rare subspecies have the distinctive markings, whereas only 5% of the beetles in the common subspecies have them. What is the probability that the beetle is in fact from the rare subspecies?

① Draw tree

1st branch existing condition

2nd branch = test result

② Label given probabilities

$$1 - 0.001 = 0.999$$

$$0.001 = 0.001$$

③ Use tree algebra to find missing probabilities

$$p(\text{rare} / \text{markings}) = \frac{p(\text{rare} \cap \text{markings})}{p(\text{markings})}$$

④ Identify relevant paths

$$= \frac{0.001(0.98)}{0.001(0.98) + 0.999(0.05)}$$

⑤ Apply Bayes theorem to highlighted paths.

$$= \frac{0.019242097}{\approx 2\%}$$