

Bayes Theorem Example

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Problem

Suppose you are studying a pair of cryptic species. In your area 5% of individuals are species A and 95% of individuals are species B. There is currently no genetic assay capable of telling them apart. They differ however in the frequency of a rare color pattern. Species A has the rare color pattern 50% of the time while species B has the rare color pattern only 2% of the time. Assume these numbers are known with certainty, from many years of field research.

Question 1

Now suppose you find one of these species with the rare color pattern. Use Bayes theorem to compute the probability that it is from species A.

Bayes Theorem Refresher

We will use *hyp* to represent our hypothesis that our specimen is species A and we will use *post* to represent having the color pattern that is more common in rare species. So the equation $P(hyp|post) = \frac{P(post|hyp)P(hyp)}{P(post)}$ would be read as the probability that a specimen is species A given that it has the color pattern common in this species is equal to the probability that this color pattern is present given that it is species A times the probability of species A divided by the probability of this color pattern.

```
posthyp <- .5
hyp <- 2/100
false.pos <- .05 * .5
true.pos <- .95 * .02
post <- false.pos + true.pos

# now we combine these in Bayes Theorem
answer <- posthyp * hyp / post
```

The chance that our specimen is species A is 0.2272727.