

1. A geneticist is studying phenotype expression in two populations of female mice, group A and group B. The mice that express the phenotype have long tails, and those that don't have short tails. 30% of the mice in group A have long tails, and 65% of the mice in group B have long tails. There are twice as many mice in group A as there are in B. A mouse is born and it is not known which of the two populations it came from, assuming that it was born with equal likelihood from each of the mice.

What is the probability that the baby mouse has a short tail?

If it has a short tail, what is the probability that it was born from a mouse in group A?

If it has a short tail, what is the probability that it was born from a mouse in group B?

What is the probability that the baby mouse has a long tail?

If it has a long tail, what is the probability that it was born from a mouse in group A?

If it has a long tail, what is the probability that it was born from a mouse in group B?

2. A police officer is questioning a suspect with the aid of a polygraph (lie detector). The polygraph readings allow the officer to detect that a lie 94% is being told of the time the statement that a suspect gives is a lie. Occasionally a false positive is given when the suspect tells the truth, this happens 11% of the time. The officer knows that the suspect will lie when giving a statement one fifth of the time.

What is the probability that the polygraph indicates that the suspect is lying?

If the polygraph indicates the suspect is lying, what is the probability they are actually lying?

If the polygraph indicates the suspect is lying, what is the probability they are actually telling the truth?

What is the probability that the polygraph indicates that the suspect is telling the truth?

If the polygraph indicates the suspect is telling the truth, what is the probability they are actually lying?

If the polygraph indicates the suspect is telling the truth, what is the probability they are in fact telling the truth?

There has recently been a murder at the Tudor Mansion, and the prime suspects are Miss Scarlet and Professor Plum. They are suspected to have committed the crime with probabilities $\frac{1}{3}$ and $\frac{2}{3}$ respectively. The weapon was either a candlestick or a dagger. Miss Scarlet is known to favor the dagger over a candlestick $\frac{2}{3}$ of the time. Professor Plum on the other hand favors the candlestick with probability $\frac{2}{3}$. If the candlestick was the murder weapon, there is a $\frac{1}{3}$ chance that the murder happened in the library and a $\frac{2}{3}$ chance it happened in the kitchen. If the dagger was the weapon, then the crime happened in the library with a $\frac{2}{3}$ probability and the kitchen with a $\frac{1}{3}$ probability.

If the murder was proven to be done in the library, what is the probability that Miss Scarlet is to blame?

If the Kitchen was the place of the murder, what is the probability that the weapon used was the dagger?