TOPIC: BAYES' THEOREM

Bayes' Theorem

- Recall: **Conditional Prob** is the prob. of event B, *given* event A happened.
  - If we DON'T know $P(A \cap B)$, or $P(A)$ we can still find $P(B|A)$ using Bayes' Theorem.

Recall

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

(Conditional Probability)

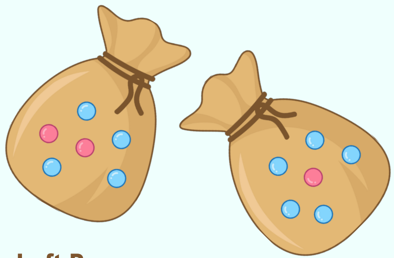
EXAMPLE

You play a game where you close your eyes and a marble is pulled from one of 2 bags. To win, you must guess which bag the marble came from. The Left Bag has 2 red & 4 blue; the Right Bag has 1 red & 5 blue. After watching people play the game, you see that 3 out of every 4 marbles drawn come from the Left Bag. On your turn, the selected marble is red. What is the probability that it came from the Left Bag?

New

$$P(B|A) = \frac{P(A|B) \cdot P(B)}{P(A|B) \cdot P(B) + P(A|B') \cdot P(B')}$$

(Bayes' Theorem)



given event $(A) =$

other event $(B) =$

complement event $(B') =$

$P(B) =$

$P(B') =$

$P(A|B) =$

$P(A|B') =$

$P(B|A) =$

PRACTICE

A rare condition affects 1 out of every 100 people. The test for this condition has the following probabilities: If a person has the condition, the test is correct 95% of the time. If a person does not have the condition, the test gives a wrong result 10% of the time. If A is the event 'tested positive' and B is the event 'has condition,' find $P(B')$, $P(A|B)$, and $P(A|B')$.

TOPIC: BAYES' THEOREM

EXAMPLE

At the peak of flu season, 10% of people in a town get sick with the flu. People can get tested to see if they have the flu, and data shows that the test will be positive 95% of the time given the patient has flu and 1% of the time given they do not have the flu. If someone tests positive, what is the probability that they have the flu?

given event $(A) =$

other event $(B) =$

complement event $(B') =$

$P(B) =$

$P(B') =$

$P(A|B) =$

$P(A|B') =$

$P(B|A) =$

New

$$P(B|A) = \frac{P(A|B) \cdot P(B)}{P(A|B) \cdot P(B) + P(A|B') \cdot P(B')}$$

(Bayes' Theorem)

PRACTICE

According to data from a metro station, 28% of trains are delayed. When compared to weather data, it was found that 73% of train delays and 35% of on-time rides were on days with precipitation. Given there is precipitation, what is the probability the train will be delayed?

New

$$P(B|A) = \frac{P(A|B) \cdot P(B)}{P(A|B) \cdot P(B) + P(A|B') \cdot P(B')}$$

(Bayes' Theorem)