Conditional Probability

Foundations of Data Analysis

January 21, 2020

Brain Teaser

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Say I have two children.

1. If I tell you the oldest child is a boy, what is the probability that the youngest is a boy?
2. If I tell you at least one of the children is a boy, what is the probability the other is a boy?
3. If I tell you one of the children is a boy and born on Tuesday, what is the probability the other is a boy?

Conditional Probability

$P(A|B)$ = "the probability of event A given that we know B happened"

Formula: $P(A|B) = P(A \cap B)/P(B)$

Multiplication Rule

$$P(A \cap B) = P(A|B)P(B)$$

Example

You are given two boxes with balls numbered 1 - 5. One box contains balls 1, 3, 5, and the other contains balls 2 and 4. You first pick a box at random, then pick a ball from that box at random. What is the probability that you pick a 2?

Example

You are analyzing the effectiveness of online advertising for a company that sells widgets. The company finds that 50% of traffic to their website comes from clicks of online ads. In addition, 20% of visitors to their website both had clicked an online ad and purchased a widget. If a person clicks on the company's ad, what is the probability that they will purchase a widget?

Example

In Charlottesville the sky is overcast on about 40% of days. If it is overcast, there is a 25% chance that it will also be windy. What is the probability that it is both overcast and windy?