Intro to Contemporary Math

Conditional Probability Intro

Department of Mathematics

UK

Announcement

- You have a homework assignment due next Monday.

Sequences of Experiments

Suppose two experiments are performed, one after the other. We will need to be careful if the results of the first experiment affect the second one.

Drawing Two Marbles

A jar has ten marbles - 7 are red and 3 are blue. If we draw just one marble, then the probability of it being blue is

$$\frac{3 \text{ blue marbles}}{10 \text{ marbles total}} = \frac{3}{10}.$$

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If we draw a second marble without replacing the first one, what is the probability of it being blue?
The number of

- marbles left in the jar
- blue marbles

have changed.

Conditional Probability

The probability that event F occurs, **given** that event E (has already) occurred, is denoted as $P(F|E)$.
This is read as "the (conditional) probability of F **given** E."
Computing $P(F|E)$ involves counting outcomes just like for usual probability, but you need to watch out for changes in:

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This is read as "the (conditional) probability of F **given** E."
Computing $P(F|E)$ involves counting outcomes just like for usual probability, but you need to watch out for changes in:

- the total number of outcomes, and
- the number of remaining outcomes described by F

caused by event E.

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If two marbles are drawn (without replacement), what is the probability of drawing a blue marble on the second draw given that the first marble drawn was blue?

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$$\frac{3 \text{ blue marbles}}{10 \text{ marbles total}} = \frac{3}{10}.$$

If two marbles are drawn (without replacement), what is the probability of drawing a blue marble on the second draw given that the first marble drawn was blue?

Since the first blue marble was not replaced,

- There are only 9 marbles left for the second draw.
- There are only 2 blue marbles left.

Drawing Two Marbles

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$$\frac{3 \text{ blue marbles}}{10 \text{ marbles total}} = \frac{3}{10}.$$

If two marbles are drawn (without replacement), what is the probability of drawing a blue marble on the second draw given that the first marble drawn was blue?

Since the first blue marble was not replaced,

- There are only 9 marbles left for the second draw.
- There are only 2 blue marbles left.

Hence the probability of drawing a blue marble on the second draw given that the first marble drawn was blue is

$$\frac{2 \text{ blue marbles left}}{9 \text{ marbles left}} = \frac{2}{9}.$$

?($5\frac{1}{2}$.1) Drawing Two Marbles

A jar has ten marbles - 7 are red and 3 are blue. If two marbles are drawn (without replacement), what is the probability of drawing a blue marble on the second draw given that the first marble drawn was red?

Drawing Two Marbles

A jar has ten marbles - 7 are red and 3 are blue. If two marbles are drawn (without replacement), what is the probability of drawing a blue marble on the second draw given that the first marble drawn was red?
Since the first red marble was not replaced,

- There are only 9 marbles left for the second draw.
- However, there are still 3 blue marbles left.

Hence the probability of drawing a blue marble on the second draw given that the first marble drawn was red is

$$\frac{3 \text{ blue marbles left}}{9 \text{ marbles left}} = \frac{3}{9}.$$