

Reasoning for Humans: Clear Thinking in an Uncertain World

PHIL 171

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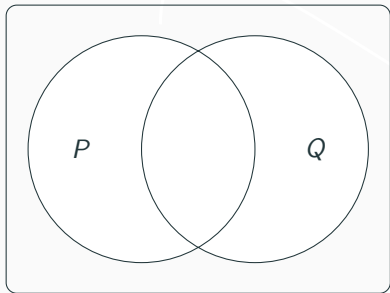
Conditional Probability

$Pr(\varphi | \psi)$: The probability of φ **given that** ψ .

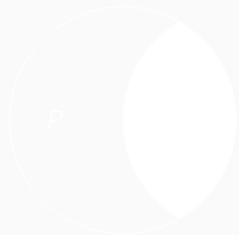
Conditional probability is the concept of the probability of something *given* or *in the light of* some evidence or new information.

Example:

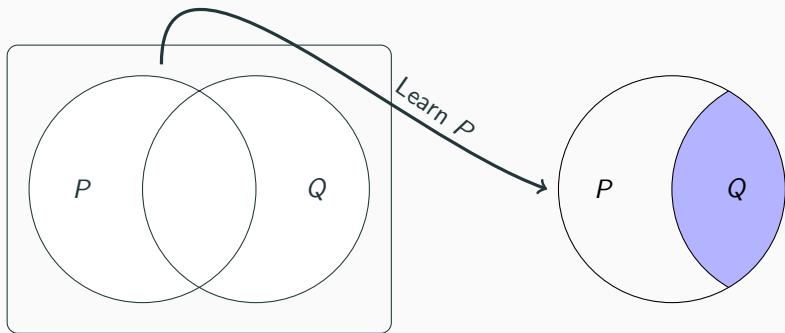
- the probability that the die lands 1, given that it lands odd, is $1/3$
- the probability that it will rain tomorrow, given that there are dark clouds in the sky tomorrow morning, is high



Learn P



$Pr(Q | P)$



$Pr(Q | P)$

$$Pr(\varphi \mid \psi) = \frac{Pr(\varphi \wedge \psi)}{Pr(\psi)}$$

Ratio Formula

$$Pr(\varphi \mid \psi) = \frac{Pr(\varphi \wedge \psi)}{Pr(\psi)}$$

(If $Pr(\psi) = 0$, then $Pr(\varphi \mid \psi)$ is undefined)

Example

	A	B
$\frac{1}{10}$	T	T
$\frac{1}{20}$	T	F
$\frac{2}{5}$	F	T
$\frac{9}{20}$	F	F

$$Pr(B) = \frac{1}{10} + \frac{2}{5} = \frac{5}{10}$$

Example

	<i>A</i>	<i>B</i>
$\frac{1}{10}$	T	T
$\frac{1}{20}$	T	F
$\frac{2}{5}$	F	T
$\frac{9}{20}$	F	F

$$Pr(B) = \frac{5}{10} \quad Pr(B | A) = ??$$

Example

	A	B
$\frac{1}{10}$	T	T
$\frac{1}{20}$	T	F
0	F	T
0	F	F

$$Pr(B) = \frac{5}{10} \quad Pr(B | A) = ??$$

Example

	A	B
$\frac{2}{3}$	T	T
$\frac{1}{3}$	T	F
0	F	T
0	F	F

$$Pr(B) = \frac{5}{10} \quad Pr(B | A) = ??$$

Example

	<i>A</i>	<i>B</i>
$\frac{2}{3}$	T	T
$\frac{1}{3}$	T	F
0	F	T
0	F	F

$$Pr(B) = \frac{5}{10} \quad Pr(B | A) = \frac{2}{3}$$

Example

	A	B	$B \wedge A$
$\frac{1}{10}$	T	T	T
$\frac{1}{20}$	T	F	F
$\frac{2}{5}$	F	T	F
$\frac{9}{20}$	F	F	F

$$Pr(B) = \frac{5}{10} \quad Pr(B | A) = \frac{Pr(B \wedge A)}{Pr(A)} = \frac{\frac{1}{10}}{\frac{1}{10} + \frac{1}{20}} = \frac{2}{3}$$