Lecture 2: Basics of Probability Theory

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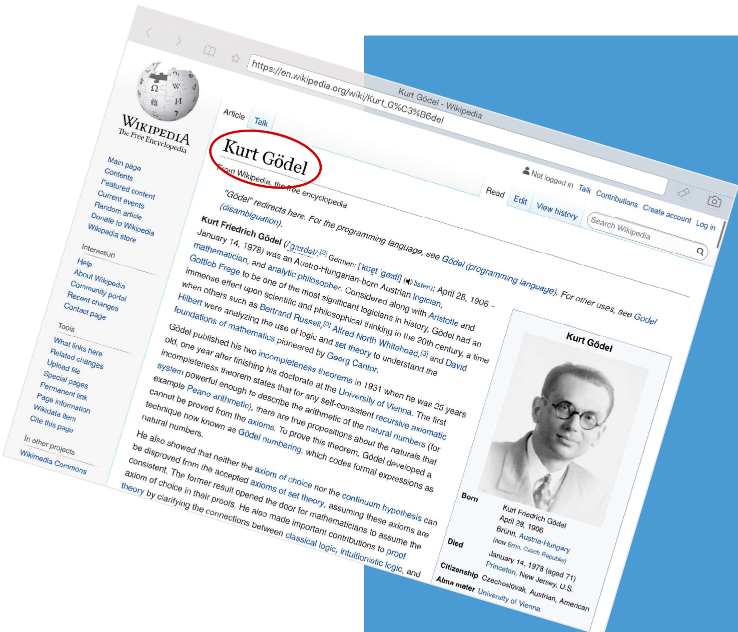
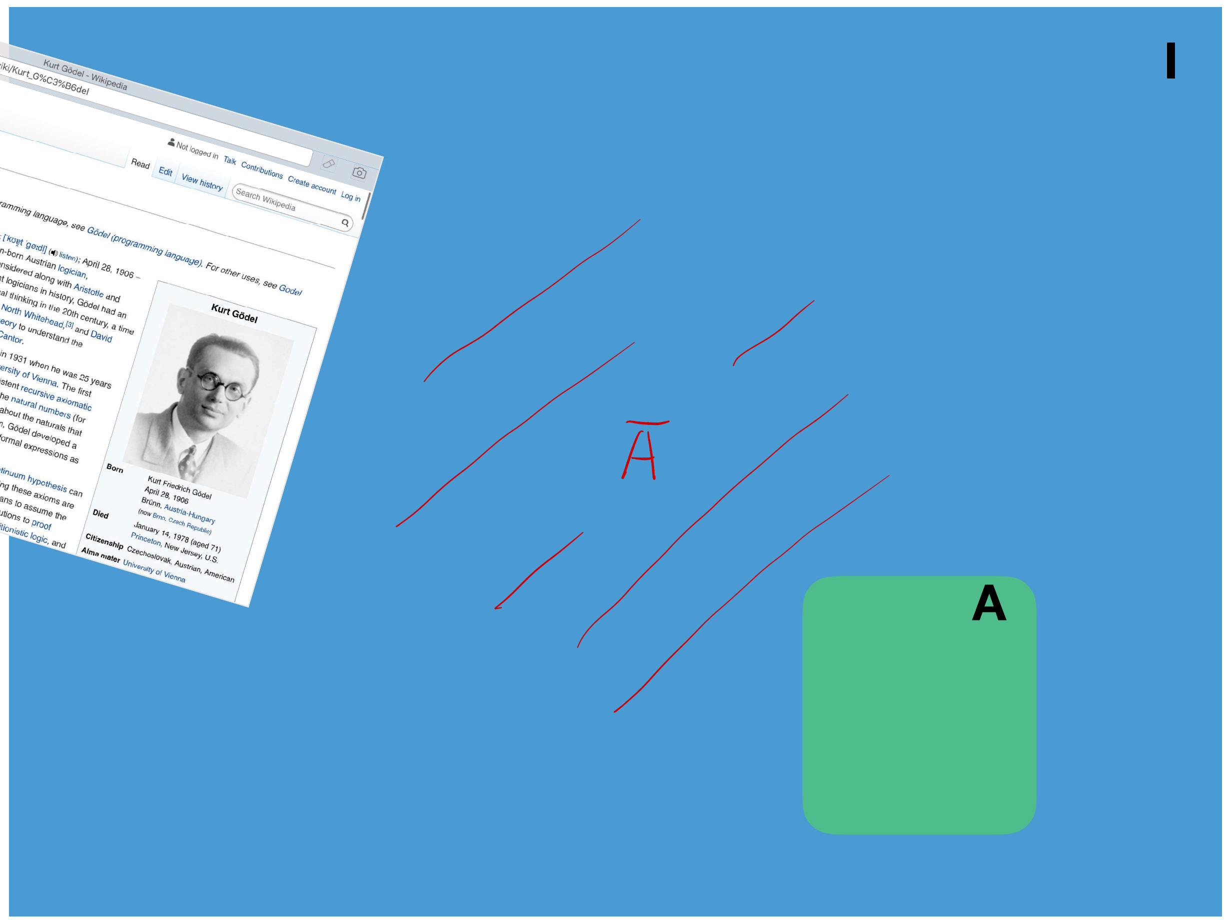
The obvious rule of probability

The obvious rule

$p(A \cup \bar{A}) = 1$

The **obvious rule:** $p(A \mid I) + p(\neg A \mid I) = 1$



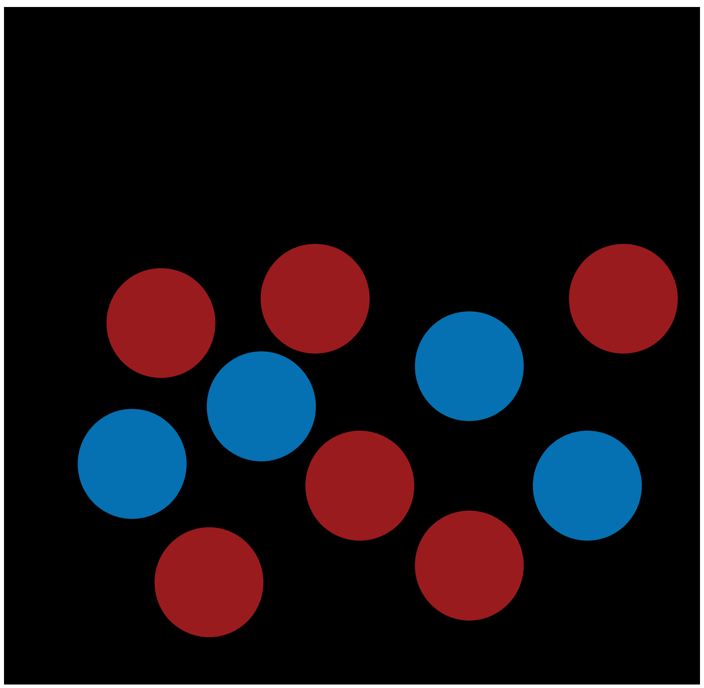


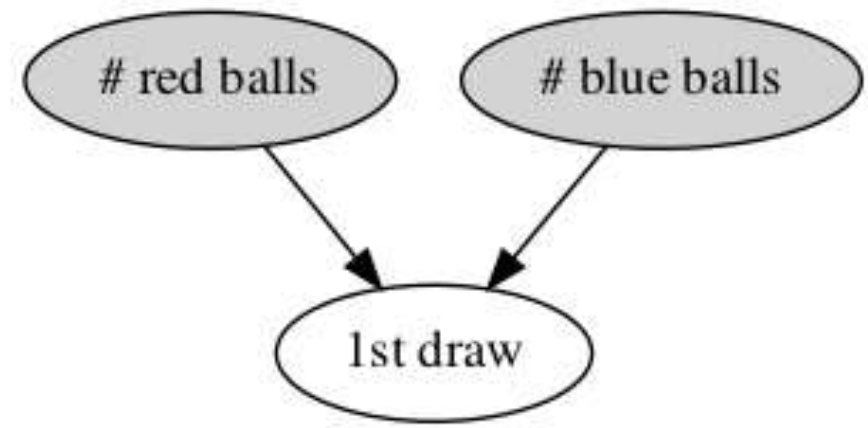
Venn Diagram

Example: Drawing balls from a box without replacement

Consider the following example of prior information I:

We are given a box with 10 balls 6 of which are red and 4 of which are blue. The box is sufficiently mixed so that when we get a ball from it, we don't know which one we pick. When we take a ball out of the box, we do not put it back.





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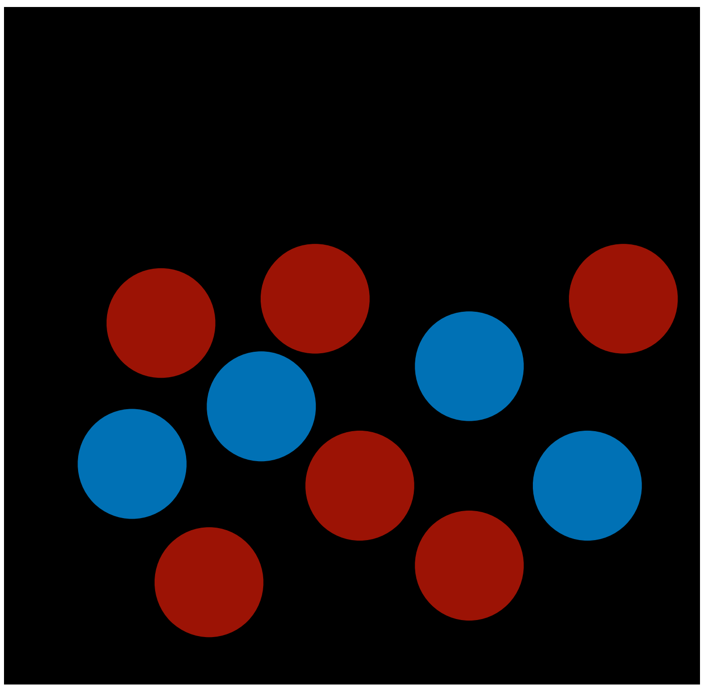

Let B_1 be the sentence:

The first ball we draw is blue.

Let's compute a probability:

$$p(B_1|I) = \frac{4}{10}$$

Insufficient Reason
Laplace.

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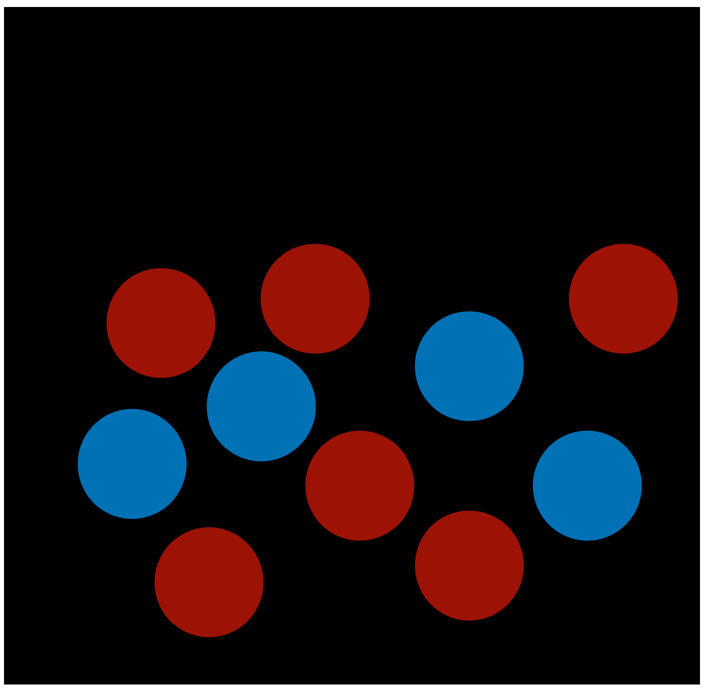

$$p(B_1 | I) = 0.4$$

What is the probability that we get a red ball ($\neg B_1 \equiv R_1$ is true)?

$$p(R_1 | I) = p(\neg B_1 | I) \overset{\text{ob.}}{\underset{\text{R.}}{=}} 1 - p(B_1 | I)$$

$$= 1 - 0.4 = 0.6$$

$$p(R_1 | I) = \frac{6}{10}$$