Probability: reasoning under uncertainty

Medical example:
1 in 100 adults has disease D.
if x has D, prob of positive test result is 90%
if x doesn't have D, prob of positive test is 15%
What is prob that your patient with a positive test result has D?

CSE examples:
1. Performance: events happen randomly. failures, data arrivals, workloads are events.
2. Patterns in data:
Netflix recommendations, Google page rank, spam detection
3. Scientific data analysis: experimental error such as measurement
4. Algorithm design: probabilistic algorithms make use of random number generator.

Counting: If some probabilistic experiment has a finite set Ω of outcomes and each outcome is equally likely, then the probability of event $A \subseteq \Omega$ is

$$P(A) = \frac{|A|}{|\Omega|}$$ ← counting

Ex: $A = \{5,6\}$, $\Omega = \{1,2,3,4,5,6\}$

$P(A) = \frac{2}{6} = \frac{1}{3}$

Counting the sizes of A and Ω can be complex.