Probability: reasoning under uncertainty

CSE examples

1. System performance: unpredictable failures, unpredictable arrival rates of packets, unpredictable workloads.
2. Patterns in data: data mining. Netflix or Amazon recommendations, Google ranking of hits. Spam detection
3. Scientific data analysis: measurement error.
4. Algorithm design: randomization

Counting

Motivation: If some probabilistic experiment has a finite sample space Ω of equally likely outcomes (e.g., roll of a fair 6-sided die), the probability of an event $A \subseteq \Omega$ is

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

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

$A = \{1,3,5\}$

$$P = \frac{|A|}{|\Omega|} = \frac{3}{6} = \frac{1}{2}$$

Counting the sizes of A and Ω can be complicated (e.g., how many 5-card hands have 2 clubs?), and we'll be studying this this week.