Intro to Probability

Example: Flipping a coin. What is the probability that it comes up heads?

50%

Terminology:

- Experiment: Flipping a coin
- Outcomes: Heads, Tails
- Trial: One flip of coin

Empirical Probability: Estimating probability by actually performing trials

$$\text{Relative Frequency of outcome} = \frac{\#\text{ occurences of outcome}}{\#\text{ trials}}$$

Example: Toss a coin 5000 times, get 2482 heads

$$\text{Rel Freq of Heads} = \frac{2482}{5000} = 0.4964$$

We expect as # of trials increases, the rel freq will get closer to 0.5.

Law of Large Numbers: As more trials of an experiment are repeated, the relative freq gets closer to the actual probability

Example: 1000 students at high school

Class	# students	Rel Freq
Freshman	210	$210/1000 = 0.21$
Soph	270	0.27
Jun	300	0.30
Sen	220	0.22

$P(\text{freshman}) = 0.21$ $P(\text{soph}) = 0.27$

$$P(\text{freshman or soph}) = \frac{210+270}{1000} = \frac{480}{1000} = 0.48$$

Sample Space: Set of all possible outcomes

({fresh, soph, jun, sen})

Simple Outcome: One element of sample space (freshman)

Examples:

i) Flipping a coin. Sample space: {Heads, Tails}

ii) Drawing a card from deck. Sample space: {cards}

iii) Toss a coin twice. Sample space: {HH, HT, TH, TT}

Properties of sample space:

a) Contain an element for every outcome

({fresh, soph, jun} would not be a good sample space)

b) Each outcome should correspond to exactly one element of our sample space

({blue eyes, brown eyes, brown hair, blonde hair, ...} would not be a good sample for human attributes)

↑ space