

Math 146 4.1 - Basic Rules of Probability

Probability is:

An **event** is any collection of results, or outcomes, from a procedure or activity.

"Making seven free throws"

A **simple event** is an event that can't be broken down further.

A couple has one child: (1) Boy, (2) girl

A couple has two children, a boy and a girl. (not simple)

The **Sample space** is the collection of all simple events.

Find the sample space of the outcomes when flipping three coins.

Probability Notation:

A, B, C, etc., denote events, i.e., for the activity "flipping three coins", we may have $A =$ getting exactly 2 tails.

$P(A)$ = the probability of event A Note: $0 \leq P(A) \leq 1$

Calculating or Finding Probabilities

Empirical or Experimental: run a simulation

$$P(A) = \frac{\text{number of times } A \text{ occurred}}{\text{number of trials made}}$$

Simulate flipping 3 coins one thousand times to find $P(\text{exactly two tails})$.

```
seq (sum (ranInt (0, 1, 3)), x, 1, 100) → L1
```

Law of large numbers states the experimental probability approaches the actual probability

Theoretical or Classical

$$P(A) = \frac{\text{number of ways } A \text{ can occur}}{n \text{ (size of the sample space)}}$$

Subjective

Make up a probability using some prior knowledge or assumptions.

$P(\text{stopped by a train on your way to school in the morning})$

Complement of an event

The complement of A is \bar{A} which is the event A NOT happening: $P(\bar{A}) =$ probability of A not happening.

Find an equation relating $P(A)$ and $P(\bar{A})$:

Find the probability of not getting a sum of 7 when rolling two die.

Unlikely -vs- Unusual

Unlikely is a small chance or probability of occurring, often when $P < 0.05$

Unusual is when an event has an unusually high number of occurrences or an unusually low number of occurrences.

Example: flip a coin 1000 times. Expect about 500 Tails; 500 T is not unusual.

But: $P(500 T) = 0.025225$. It's unlikely for that to happen on any one particular trial.