

Intro to Probability

Summary

1.

Sample Space

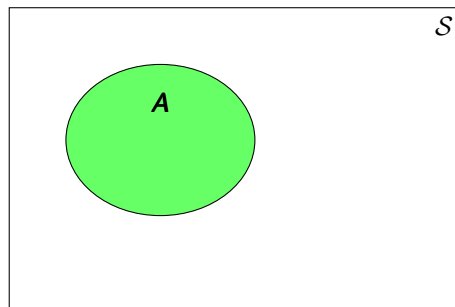
The **sample space** is a listing of all possible outcomes.

Common sample spaces:

- *Flipping a coin*: Heads, Tails
- *Rolling a single die*: 1, 2, 3, 4, 5, 6
- *Drawing a card from a standard deck*: Ace of spades, ace of hearts, ... , king of diamonds

Venn Diagrams

A **Venn diagram** is a visualization of events and sample spaces.



Probability

Probability is a measure of the likelihood of an event occurring.

$$\text{Probability} = \frac{\text{number of ways the event can occur}}{\text{total number of outcomes in sample space}}$$

Example 1. Determine the probability of each event.

(a) Flipping a coin and landing on heads

(b) Rolling a number less than 3 on a single die

(c) Drawing a face card (jack, queen, or king) from a standard deck

(d) The number of students in each class at a college is shown in the table below.

Freshmen	Sophomore	Junior	Senior
1670	2017	2975	3026

Find the probability that a randomly selected student is a sophomore.

(e) The 36 possible sums from rolling 2 dice are shown below.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

What is the probability of rolling a sum of 7?

Types of Probability

- Classical (a.k.a. *theoretical*) \rightarrow each outcome has an equal chance of being selected.
- Experimental \rightarrow based on events that have actually occurred.
- Subjective \rightarrow based on opinion

Example 2. Identify each of the following as experimental probability or subjective probability.

(a) To determine if a coin is fair, it is flipped 100 times and tails occurs 46 times.

(b) Your uncle says there is a 95% chance that Amazon's stock price will go up.

Law of Large Numbers

As the number of events increases, the experimental probability of an event will approach the classical (theoretical) probability.

As you flip a fair coin more and more times, $P(\text{tails}) \rightarrow \frac{1}{2}$.

Rules of Probability Club

1. Each probability must be a value between 0 and 1, inclusive.
 - A probability of 0 is an *impossible event*.
 - A probability of 1 is a *certain event*.
2. The sum of all possible probabilities of a sample space must equal 1.