Sample Spaces and Events

Definitions

In the context of probability, we often deal with the probability of some particular outcome of some experiment.

The set of all outcomes of an experiment is called the sample space.

ex If our experiment was to flip 3 coins then an example outcome is TTH.

The sample space is all potential outcomes, so

$$S = \{HHH, HTH, THH, TTH, HHT, HTT, THT, TTT\}$$

Given a sample space S, an event E is a subset of S, meaning an event is a set of outcomes.

The outcomes in an event are called favorable outcomes.

We say an event occurs if it contains at least 1 outcome.

Consider the experiment of flipping a coin followed by rolling a die.

- example outcomes: T3, H6
- Let H to be the event of flipping a heads. Then

$$H = \{H1, H2, H3, H4, H5, H6\}$$

- Let E be the event of rolling an even number.

So $E = \{H2, T2, H4, T4, H6, T6\}$

Describing Events w/ Set Operations

Let's continue with the experiment of flipping a coin and then rolling a die.

Let H be the event of flipping a heads and E be the event of rolling an even number.

We can use set notation to more concisely describe events.

$E \cap H$ the event of rolling an even # and flipping a heads

$= \{H2, H4, H6\}$

Consider the experiment of rolling a red die and then a blue die.

- an example outcome: 3 2 * note how this is different than 2 3
- Let V be the event of rolling two dice that sum to 7

$$V = \{16, 25, 34, 43, 52, 61\}$$

- Let E be the event of rolling two even #s

$$E = \{22, 24, 26, 42, 44, 46, 62, 64, 66\}$$

- Is $V \cap E$ feasible? No, it is not feasible.

$$V \cap E = \{\} = \emptyset$$

There is no way to roll 2 dice s.t. their sum is 7 and both rolls are even.