Estimating Probabilities: Takeaways

Syntax

- Simulating a coin toss using Python:

```
from numpy.random import seed, randint

seed(1)

def coin_toss():
    if randint(0, 2) == 1:
        return 'HEAD'
    else:
        return 'TAIL'

coin_toss()
```

Concepts

- A **random experiment** is any process for which we can't predict outcomes with certainty. Examples of random experiments include: the toss of a coin and the rolling of a die.
- When we calculate the probability of an event by performing an experiment, we calculate the **experimental** — or **empirical probability** — of the event.
- Generally, for any event *E* (like a coin landing heads up), we can find its empirical probability by using the following formula:

$$P(E) = \frac{\text{number of times event E happened}}{\text{number of times we repeated the experiment}}$$

- Generally, the empirical probability of an event (a coin landing heads up, getting a 5 when we roll a die) approaches the true probability value as the number of trials of the random experiment (a coin toss, the rolling of a die) increases without bound.
- When we calculate the probability of an event under the assumption that the outcomes have equal chances of occurring, we say that we're calculating the **theoretical probability** of an event.
- Generally, for any event *E*, we can find its theoretical probability by using the following formula:

$$P(E) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$

- The theoretical probability formula only works as long as the assumption of outcomes having equal chances of occurring is reasonable. When the assumption is violated, we can still compute theoretical probabilities by transforming the problem into a proportion problem.

Resources

- An easy intro to some basic probability concepts
- Tutorial: Basic Statistics in Python — Probability