Randomness and Probability

Logistics

- 10 minutes to re-group and decide who's going to present
- 2 minute presentation from each group showing your analysis of NBA Salaries vs Team Success
- Next class: midterm review + making cheat sheet

Descriptive vs. Inferential Statistics

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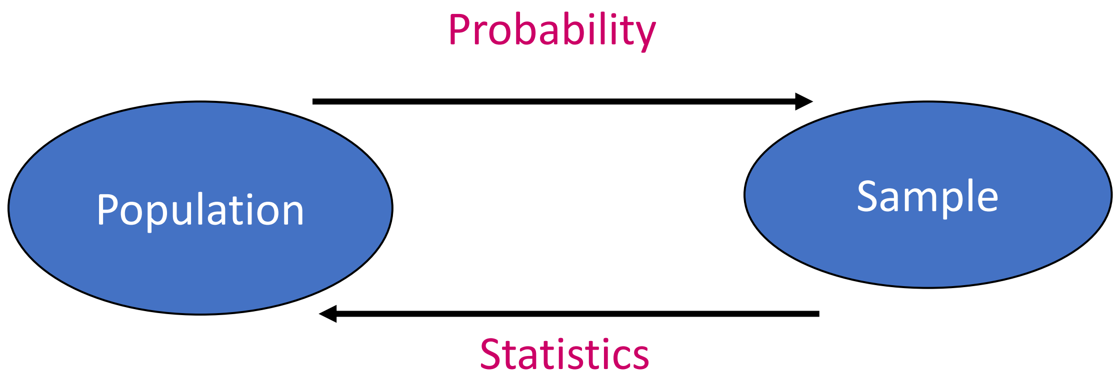
- Inferential statistics: methods to make predictions about new data based on a sample of data (e.g., 'how many times will my team win if I pay my players X $?')

Probability

- A probability is a quantitative description of the likelihood of various outcomes
- Provides a bridge between descriptive and interential statistics



Experiments & Events

- Experiment: the process by which an observation or measurement is obtained

- Event: the outcome of an experiment
    - When an experiment is performed, a particular event either happens or doesn't

Experiments & Events

- Experiment: Toss a die
- Event:
  - A: observe a number greater than 2
  - B: observe an odd number

Experiments & Events

- Two events are ***mutually exclusive*** if when one event occurs, the other cannot (and vice versa)

- **Experiment:** Toss a die
- **Event:**
  - **A:** observe a number greater than 2
  - **B:** observe an odd number
  - **C**: observe a 6
  - **D**: observe a 3

Not mutually exclusive

Mutually exclusive

Probability of an Event

- Probability of event A measures “how often” A will occur.
  - Written as P(A).

- Suppose an experiment is performed *n* times. The relative frequency of A is:

$$\frac{\#\ of\ times\ \boldsymbol{A}\ occurs}{n} = \frac{f}{n}$$

- If we let n get infinitely large:

$$P(A) = \lim_{n\to\infty} \frac{f}{n}$$

Probability of an Event

- P(A) must be between 0 and 1
  - If A can never occur: P(A) = 0
  - If A always occurs: P(A) = 1

- The sum of the probabilities for all events equals 1

- Events can be decomposed into ‘simple’ events
  - e.g., for a 6-sided die, the event ‘observe an odd number’ can be decomposed into the events, ‘observe a 1’, ‘observe a 3’, ‘observe a 5’

- The probability of an event = the sum of the probability of all the simple events that define that event

Finding Probabilities

- Probabilities can be found using:
  - Common sense estimates based on equally likely events (e.g., a coin flip)
  - Estimates from empirical studies or simulations


MONTY


MONTY


1
2
3


1
2
3


1
2

Simulation

- We can get estimate the probabilities for whether you should switch or not by running a simulation