Control Statements
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These statements control the sequence of computations that are performed in a program

- The keywords `if` and `for` begin control statements
- The purpose of `if` is to define functions that choose different behavior based on their arguments
- The purpose of `for` is to perform a computation for every element in a list or array

(Demo)
The Monty Hall Problem
Monty Hall Problem

1

2

Open door (goat)

Probability
Basics

- Lowest value: 0
  - Chance of event that is impossible
- Highest value: 1 (or 100%)
  - Chance of event that is certain

- If an event has chance 70%, then the chance that it doesn’t happen is
  - $100\% - 70\% = 30\%$
  - $1 - 0.7 = 0.3$ (Demo)
Equally Likely Outcomes

Assuming all outcomes are equally likely, the chance of an event $A$ is:

\[
P(A) = \frac{\text{number of outcomes that make } A \text{ happen}}{\text{total number of outcomes}}
\]
Fraction of a Fraction

Stage 1
\[ \frac{1}{3} \]
\[ \frac{2}{3} \]

Stage 2
\[ \frac{1}{2} \]
\[ \frac{1}{2} \]

The winner: \[ \frac{1}{2} \times \frac{1}{3} \]

(Demo)
Multiplication Rule

Chance that two events $A$ and $B$ both happen

$$= P(A \text{ happens}) \times P(B \text{ happens given that } A \text{ has happened})$$

- The answer is *less than or equal to* each of the two chances being multiplied
- The more conditions you have to satisfy, the less likely you are to satisfy them all

(Demo)
Addition Rule

If event $A$ can happen in exactly one of two ways, then

$$P(A) = P(\text{first way}) + P(\text{second way})$$

- The answer is *greater than or equal to* the chance of each individual way
Example: At Least One Head

● In 3 tosses:
  ○ Any outcome except TTT
  ○ $P(\text{TTT}) = \left(\frac{1}{2}\right) \times \left(\frac{1}{2}\right) \times \left(\frac{1}{2}\right) = \frac{1}{8}$
  ○ $P(\text{at least one head}) = 1 - P(\text{TTT}) = \frac{7}{8} = 87.5\%$

● In 10 tosses:
  ○ $1 - \left(\frac{1}{2}\right)^{\times 10}$
  ○ 99.9\%