Independence

Random variables $X$ and $Y$ are independent if and only if $P(X = x, Y = y) = P(X = x)P(Y = y)$.

Mathematical examples:

- If I flip a coin twice, is the second outcome independent from the first outcome?
Independence

Random variables $X$ and $Y$ are *independent* if and only if

$$P(X = x, Y = y) = P(X = x)P(Y = y).$$

Mathematical examples:

- If I flip a coin twice, is the second outcome independent from the first outcome?

- If I draw two socks from my (multicolored) laundry, is the color of the first sock independent from the color of the second sock?
Independence

Intuitive Examples:

- Independent:
  - you use a Mac / the Hop bus is on schedule
  - snowfall in the Himalayas / your favorite color is blue
Independence

Intuitive Examples:

- **Independent:**
  - you use a Mac / the Hop bus is on schedule
  - snowfall in the Himalayas / your favorite color is blue

- **Not independent:**
  - you vote for Mitt Romney / you are a Republican
  - there is a traffic jam on 25 / the Broncos are playing
Independence

Sometimes we make convenient assumptions.

- the values of two dice (ignoring gravity!)
- the value of the first die and the sum of the values
- whether it is raining and the number of taxi cabs
- whether it is raining and the amount of time it takes me to hail a cab
- the first two words in a sentence