# Bernoulli random variable

$$P(X = x \mid p) = \begin{cases} p, & \text{if } x = 1 \\ 1 - p, & \text{if } x = 0 \end{cases}$$

- A random variable for modeling binary events
- Two possible outcomes:
  - Success - value 1
  - Failure - value 0

| $X$ | $P(X = x)$ |
|---|---|
| 0 | $1 - p$ |
| 1 | $p$ |

- Single parameter $p$, probability of a success
- multiple Bernoulli r.v. can be combined to model more complex random variables
- Shorthand notation: $X \sim \text{Bern}(p)$
- $E(X) = p,\ V(X) = p(1 - p)$

# geometric random variable

- A r.v. modeling the number of (identical) Bernoulli trials needed to obtain the first success
- Infinite outcomes $\{1,2,3\ldots,\infty\}$
- Single parameter $p$, probability of a success for each trial
- Shorthand notation: $X \sim \text{Geo}(p)$
- $E(X) = \frac{1}{p},\ V(X) = \frac{1-p}{(p^2)}$

$$P(X = x \mid p) = p(1-p)^{x-1}$$

| $X$ | $P(X = x)$ |
|---|---|
| 1 | $p$ |
| 2 | $p(1-p)$ |
| 3 | $p(1-p)^2$ |
| 4 | $p(1-p)^3$ |
| $\vdots$ | $\vdots$ |
| $\infty$ | $p(1-p)^{\infty} \approx 0$ |