Notable Discrete Distributions

Bernoulli(p): Consider an experiment with **only two possible outcomes**, encoded as a random variable X taking values 1, with probability p; and 0, with probability (1-p). $X \sim Bernoulli(p)$.

Pmf: $p(x) = p^x (1-p)^{1-x}, x = 0, 1$. **Mean:** $\mu = p$. **Variance:** $\sigma^2 = p(1-p)$.

E.g. tossing a coin with probability p for heads: X =1 for heads;X =0 for tails.

Binomial(n, p): Consider n identical, independent Bernoulli(p) trials $X_1, \ldots, X_n$. Let $X = \sum_{i=1}^{n} X_i$ **be the total number of 1s observed in the n trials**. X is a random variable taking values in $\{0, 1, 2, \ldots, n\}$: $X \sim Binomial(n, p)$.

Pmf: $p(x) = \binom{n}{x} p^x (1-p)^{n-x}, x = 0, 1, 2, \ldots, n$. **Mean:** $\mu = np$.

Variance: $\sigma^2 = np(1-p)$. **Skewness:** $\gamma_1 = \frac{1-2p}{\sqrt{np(1-p)}}$.

E.g. tossing a fair coin n times, X may be the number of heads obtained, p = 1/2.