## Distributions

Binomial:

$$P\{X = k\} = \binom{n}{k} p^k (1-p)^{n-k}, \quad k = 0, 1, \ldots, n.$$

$$E[X] = np, \qquad \text{Var}(X) = np(1-p) \qquad M_X(t) = (pe^t + 1 - p)^n.$$

Geometric:

$$P\{X = k\} = p(1-p)^{k-1}, \qquad k = 1, 2, \ldots.$$

$$E[X] = 1/p, \qquad \text{Var}(X) = (1-p)/p^2, \qquad M_X(t) = \frac{pe^t}{1-(1-p)e^t}.$$

Poisson:

$$P\{X = k\} = \frac{\lambda^k}{k!} e^{-\lambda}, \qquad k = 0, 1, 2, \ldots.$$

$$E[X] = \lambda, \qquad \text{Var}(X) = \lambda, \qquad M_X(t) = e^{\lambda(e^t - 1)}.$$

Uniform:

$$f_X(x) = 1/(b-a), \qquad a \le x \le b.$$

$$E[X] = (a+b)/2, \qquad \text{Var}(X) = (b-a)^2/12, \qquad M_X(t) = (e^{bt} - e^{at})/(b-a).$$

Exponential:

$$f_X(x) = \lambda e^{-\lambda x}, \qquad x \ge 0.$$

$$E[X] = 1/\lambda, \qquad \text{Var}(X) = 1/\lambda^2, \qquad M_X(t) = \frac{\lambda}{\lambda - t}.$$

Normal:

$$f_X(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}, \qquad -\infty < x < \infty.$$

$$E[X] = \mu, \qquad \text{Var}(X) = \sigma^2, \qquad M_X(t) = e^{\mu t + \sigma^2 t^2/2}.$$

(Densities and mass functions are zero at arguments for which their value is not specified above.)

## Formulas

$$\sum_{n=0}^{\infty} x^n = \frac{1}{1-x}, \qquad |x| < 1.$$

$$M_X(t) = E[e^{tX}], \qquad M_{a+bX}(t) = e^{at} M_X(bt) \qquad E[X^n] = M_X^{(n)}(0)$$

$$P(E) = \sum_i P(E \mid F_i) P(F_i), \qquad \text{if} \quad \bigcup_i F_i = S \text{ and } F_i F_j = \emptyset,\ i \ne j.$$

$$E\left[\sum_{i=1}^n X_i\right] = \sum_{i=1}^n E[X_i], \qquad \text{Var}\left(\sum_{1 \le i \le n} X_i\right) = \sum_{1 \le i \le n} \text{Var}(X_i) + \sum_{1 \le i \ne j \le n} \text{Cov}(X_i, X_j)$$