**Formulas**

$$\mathrm{P}(F_j|E) = \frac{\mathrm{P}(EF_j)}{\mathrm{P}(E)} = \frac{\mathrm{P}(F_j)\mathrm{P}(E|F_j)}{\sum_i \mathrm{P}(F_i)\mathrm{P}(E|F_i)}$$

Bernoulli($p$): $E(X) = p$, $\mathrm{Var}(X) = p(1-p)$, $\phi(t) = (1-p) + pe^t$

Binomial($n, p$): $E(X) = np$, $\mathrm{Var}(X) = np(1-p)$, $\phi(t) = [(1-p) + pe^t]^n$

Geometric($p$): $E(X) = \dfrac{1}{p}$, $\mathrm{Var}(X) = \dfrac{1-p}{p^2}$, $\phi(t) = \dfrac{pe^t}{1-(1-p)e^t}$

Poisson($\lambda$): $E(X) = \lambda$, $\mathrm{Var}(X) = \lambda$, $\phi(t) = e^{\lambda(e^t-1)}$

Exponential($\lambda$): $E(X) = \dfrac{1}{\lambda}$, $\mathrm{Var}(X) = \dfrac{1}{\lambda^2}$, $\phi(t) = \dfrac{\lambda}{\lambda - t}$

$\mathrm{var}(X) = E(X^2) - [E(X)]^2$

$\mathrm{cov}(X, Y) = E(XY) - E(X)E(Y)$

$\mathrm{var}(X+Y) = \mathrm{var}(X) + \mathrm{var}(Y) + 2\,\mathrm{cov}(X, Y)$

Gambler's Ruin: $y_i = \dfrac{1-r^i}{1-r^N}$ if $r \neq 1$; $y_i = \dfrac{i}{N}$ if $r = 1$

$$\mathrm{P}\{S_n^A < S_m^B\} = \sum_{i=0}^{m-1} \binom{n+m-1}{n+i} p^{n+i}(1-p)^{m-1-i}$$