Some Useful Formulas

Conditional Probability: $\mathbb{P}(A|B) = \dfrac{\mathbb{P}(A \cap B)}{\mathbb{P}(B)}$, provided that $\mathbb{P}(B) \neq 0$.

Rule of Total Probability: If $B_1, B_2, \ldots, B_k$ constitute a partition of the sample space, then $\mathbb{P}(A) = \mathbb{P}(A|B_1)\mathbb{P}(B_1) + \mathbb{P}(A|B_2)\mathbb{P}(B_2) + \cdots + \mathbb{P}(A|B_k)\mathbb{P}(B_k)$

Bayes' Rule: If $B_1, B_2, \ldots, B_k$ constitute a partition of the sample space, and $\mathbb{P}(A) \neq 0$, then $\mathbb{P}(B_r|A) = \dfrac{\mathbb{P}(A|B_r)\mathbb{P}(B_r)}{\mathbb{P}(A|B_1)\mathbb{P}(B_1) + \mathbb{P}(A|B_2)\mathbb{P}(B_2) + \cdots + \mathbb{P}(A|B_k)\mathbb{P}(B_k)}$

Expectation, Mean and Variance:

If X is a discrete r.v., and $f(x)$ is its probability distribution function, then
$\mu = \mathbb{E}[X] = \sum_x x f(x)$ and $\mathbb{V}ar(X) = \mathbb{E}[(X-\mu)^2] = \sum_x (x-\mu)^2 f(x) = \mathbb{E}[X^2] - (\mathbb{E}[X])^2$
If X is a continuous r.v., and $f(x)$ is its probability density function, then
$\mu = \mathbb{E}[X] = \int_{-\infty}^{\infty} x f(x) dx$ and $\mathbb{V}ar(X) = \mathbb{E}[(X-\mu)^2] = \int_{-\infty}^{\infty} (x-\mu)^2 f(x) = \mathbb{E}[X^2] - (\mathbb{E}[X])^2$

Moment Generating Function:

If X is a discrete r.v., and $f(x)$ is its probability distribution function, then $M_X(t) = \mathbb{E}[e^{tX}] = \sum_x e^{tx} f(x)$.

If X is a continuous r.v., and $f(x)$ is its probability density function, then $M_X(t) = \mathbb{E}[e^{tX}] = \int_{-\infty}^{\infty} e^{tx} f(x) dx$.

Discrete Uniform Distribution:
$f(x;k) = \frac{1}{k}$ for $x = 1, 2, \ldots, k$
Parameter: k is a positive integer
Mean and Variance: $\mu = \frac{k+1}{2}$ and $\sigma^2 = \frac{k^2-1}{12}$

Bernoulli Distribution:
$f(x;\theta) = \theta^x (1-\theta)^{1-x}$ for $x = 0, 1$
Parameter: $0 < \theta < 1$
Mean and Variance: $\mu = \theta$ and $\sigma^2 = \theta(1-\theta)$

Binomial Distribution:
$b(x;n,\theta) = \binom{n}{x}\theta^x(1-\theta)^{n-x}$ for $x = 0, 1, 2, \ldots, n$
Parameters: n is a positive integer and $0 < \theta < 1$
Mean and Variance: $\mu = n\theta$ and $\sigma^2 = n\theta(1-\theta)$

Geometric Distribution:
$g(x;\theta) = \theta(1-\theta)^{x-1}$ for $x = 1, 2, 3, \ldots$
Parameter: $0 < \theta < 1$
Mean and Variance: $\mu = \frac{1}{\theta}$ and $\sigma^2 = \frac{1-\theta}{\theta^2}$

Negative Binomial Distribution:
$b*(x;k,\theta) = \binom{x-1}{k-1}\theta^k(1-\theta)^{x-k}$ for $x = k, k+1, k+2, \ldots$
Parameter: $0 < \theta < 1$
Mean and Variance: $\mu = \frac{k}{\theta}$ and $\sigma^2 = \frac{k(1-\theta)}{\theta^2}$

Poisson Distribution:
$p(x;\lambda) = \frac{\lambda^x e^{-\lambda}}{x!}$ for $x = 0, 1, 2, \ldots$
Parameter: $\lambda > 0$
Mean and Variance: $\mu = \lambda$ and $\sigma^2 = \lambda$

Hypergeometric Distribution:
$h(x;n,N,M) = \dfrac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}}$ for $x = 0, 1, \ldots, n$
Parameters: n, N, M.
Mean and Variance: $\mu = \frac{nM}{N}$ and $\sigma^2 = \frac{nM(N-M)(N-n)}{N^2(N-1)}$

Continuous Uniform Distribution:
$f(x;\alpha,\beta) = \dfrac{1}{\beta-\alpha}$ for $\alpha < x < \beta$, 0 elsewhere.
Mean and Variance: $\mu = \dfrac{\alpha+\beta}{2}$ and $\sigma^2 = \dfrac{(\beta-\alpha)^2}{12}$

Exponential Distribution:
$f(x;\lambda) = \lambda e^{-\lambda x}$ for $x > 0$, 0 elsewhere.
Mean and Variance: $\mu = \dfrac{1}{\lambda}$ and $\sigma^2 = \dfrac{1}{\lambda^2}$