Discrete Distributions

Distribution	Parameters	Probability Function $p(x)$	Mean $E[X]$	Variance $Var[X]$	Moment Generating Function $M_X(t)$
Uniform	$N > 0$, integer	$\frac{1}{N}$ $x = 1, 2, \ldots, N$	$\frac{N+1}{2}$	$\frac{N^2-1}{12}$	$\frac{e^t(e^{Nt}-1)}{N(e^t-1)}$
Binomial	$n > 0$ integer $0 < p < 1$	$\binom{n}{x} p^x (1-p)^{n-x}$ $(x = 0, 1, \ldots, n)$	np	$np(1-p)$	$(1-p+pe^t)^n$
Poisson	$\lambda > 0$	$\frac{e^{-\lambda}\lambda^x}{x!}$ $(x = 0, 1, 2, \ldots)$	λ	λ	$e^{\lambda(e^t-1)}$
Geometric	$0 < p < 1$	$(1-p)^x \cdot p$ $(x = 0, 1, 2, \ldots)$	$\frac{1-p}{p}$	$\frac{1-p}{p^2}$	$\frac{p}{1-(1-p)e^t}$
Negative Binomial	$0 < p < 1$ $r > 0$	$\binom{r+x-1}{x}(1-p)^x \cdot p^r$ $(x = 0, 1, 2, \ldots)$	$\frac{r(1-p)}{p}$	$\frac{r(1-p)}{p^2}$	$\left[\frac{p}{1-(1-p)e^t}\right]^r$
Hyper-geometric	$M > 0$ $0 \leq K \leq M$ $1 \leq n \leq M,$ integer	$\frac{\binom{K}{x}\binom{M-K}{n-x}}{\binom{M}{n}}$ $x \leq \min[n, K]$	$\frac{nK}{M}$	$\frac{nK(M-K)(M-n)}{M^2(M-1)}$	
Multinomial	$n, p_1, p_2, \ldots, p_k$ $0 < p_i < 1$	$\frac{n!}{x_1! \cdot x_2! \ldots x_k!} \cdot p_1^{x_1} \cdot p_2^{x_2} \ldots p_k^{x_k}$ $(x_1 + x_2 + \ldots + x_k = n)$	$E[X_i] = np_i$	$Var[X_i] = np_i(1-p_i)$	

Continuous Distributions

Distribution	**Parameters**	**Probability Density Function** $f(x)$	**Mean** $E[X]$	**Variance** $Var[X]$	**Moment Generating Function** $M_X(t)$
Uniform	$a < b$	$\frac{1}{b-a}$ $(a < x < b)$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	$\frac{e^{bt}-e^{at}}{(b-a)\cdot t}$
Normal	μ (any number) $\sigma^2 > 0$	$\frac{1}{\sigma\cdot\sqrt{2\pi}} \cdot e^{-(x-\mu)^2/2\sigma^2}$ $(-\infty < x < \infty)$	μ	σ^2	$\exp\left[\mu t + \frac{\sigma^2 t^2}{2}\right]$
Exponential	$\frac{1}{\lambda} = \theta > 0$	$\lambda e^{-\lambda x}$ $(x > 0)$ $F(x) = 1 - e^{-\lambda x}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\frac{\lambda}{\lambda - t}$
Gamma	$\alpha > 0$ $\beta > 0$	$\frac{\beta^\alpha \cdot x^{\alpha-1} \cdot e^{-\beta x}}{\Gamma(\alpha)}, \quad (x > 0)$	$\frac{\alpha}{\beta}$	$\frac{\alpha}{\beta^2}$	$\left[\frac{\beta}{\beta - t}\right]^\alpha$