Summary

Models for Discrete Distributions

Name	Remarks	Probability mass function	values of X	Parameter Space	Mean	Variance
Discrete Uniform	Outcomes that are equally likely (finite)	$f(x) = \frac{1}{N}$	$x = 1, 2, \ldots, N$	$N = 1, 2, \ldots$	$\frac{N+1}{2}$	$\frac{N^2-1}{12}$
Bernoulli	Bernoulli trial	$f(x) = \theta^x(1-\theta)^{1-x}$	$x = 0, 1$	$0 \leq \theta \leq 1$	θ	$\theta(1-\theta)$
Binomial	X = Number of successes in n fixed trials	$f_X(x) = \binom{n}{x}\theta^x(1-\theta)^{n-x}$	$x = 0, 1, 2, \ldots, n$	$0 \leq \theta \leq 1$; $n = 1, 2, 3, \ldots$	$n\theta$	$n\theta(1-\theta)$
Geometric	X = Number of failures before the first success	$f_X(x) = \theta(1-\theta)^x$	$x = 0, 1, 2, \ldots$	$0 \leq \theta \leq 1$	$\frac{1-\theta}{\theta}$	$\frac{1-\theta}{\theta^2}$
Poisson	X = number of events in a given period of time, space, region or length	$f_X(x) = \frac{e^{-\lambda}(\lambda)^x}{x!}$	$x = 0, 1, 2, \ldots$	$\lambda > 0$	λ	λ

Models for Continuous Distributions

Name	Probability density function	Values of X	Parameter Space	Mean	Variance
Uniform	$f_X(x) = \frac{1}{b-a}$	$a \leq x \leq b$	$-\infty < a < b < \infty$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
Normal (Gaussian)	$f_X(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$	$-\infty < x < \infty$	$-\infty < \mu < \infty;\ \ \sigma > 0$	μ	σ^2
Gamma	$f_X(x) = \frac{1}{\Gamma(\alpha)\beta^\alpha} x^{\alpha-1} e^{-x/\beta}$	$0 < x < \infty$	$\alpha > 0;\ \ \beta > 0$	$\alpha\beta$	$\alpha\beta^2$
Exponential	$f_X(x) = \frac{1}{\beta} e^{-x/\beta}$	$0 < x < \infty$	$\beta > 0$	β	β^2
Beta	$f_X(x) = \frac{1}{B(\alpha,\beta)} x^{\alpha-1}(1-x)^{\beta-1}$	$0 < x < 1$	$\alpha > 0;\ \ \beta > 0$	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta+1)(\alpha+\beta)^2}$
Chi-square	$f_X(x) = \frac{1}{2^{k/2}\Gamma(k/2)} x^{k/2-1} e^{-x/2}$	$x \in (0,\infty)$ if $k = 1$, otherwise $x \in [0,\infty)$	$k = 1, 2, \ldots$	k	$2k$
Weibull	$$f_X(x) = \begin{cases} f_X(x) = \frac{k}{\lambda}\left(\frac{k}{\lambda}\right)^{k-1} e^{-(x/\lambda)^k} & 0 \leq x \geq 0 \\ 0 & x < 0 \end{cases} \quad (4.8)$$	$x \in [0,\infty)$	scale-$\lambda \in (0,\infty)$, shape-$k \in (0,\infty)$	$\lambda\Gamma(1+1/k)$	$\lambda^2\left[\Gamma(\left(1+\frac{2}{k}\right) - (\Gamma^2\left(1+\frac{1}{k}\right))\right]$