Table 3.1 Univariate distributions available in WinBUGS

Distribution name	WinBUGS syntax	Probability or density function $f(x)$	Mean	Variance
		Discrete distributions		
(1) Bernoulli	`x ~ dbern(p)`	$p^x(1-p)^{1-x}$	p	$p(1-p)$
(2) Binomial	`x ~ dbin(p, n)`	$n!p^x(1-p)^{n-x}/[x!(n-x)!]$	np	$np(1-p)$
(3) Categorical	`x ~ dcat(p[])`	p_x	$\sum_{x=1}^{K} xp_x$	$\sum_{x=1}^{K} [x-E(x)]^2 p_x$
(4) Negative binomial	`x ~ dnegbin(p, r)`	$(x+r-1)!p^r(1-p)^x/[x!(r-1)!]$	$r(1-p)/p$	$r(1-p)/p^2$
(5) Poisson	`x ~ dpois(lambda)`	$\exp(-\lambda)\lambda^x/x!$	λ	λ
		Continuous distributions		
(6) Beta	`x ~ dbeta(a, b)`	$\Gamma(a+b)x^{a-1}(1-x)^{b-1}/[\Gamma(a)\Gamma(b)]$	$a/(a+b)$	$ab/[(a+b)^2(a+b+1)]$
(7) Chi-squared	`x ~ dchisqr(k)`	See gamma$(k/2, \frac{1}{2})$	k	$2k$
(8) Double exponential	`x ~ ddexp(mu, tau)`	$\frac{1}{2}\tau\exp(-\tau\|x-\mu\|)$	μ	$\sqrt{2}/\tau$
(9) Exponential	`x ~ dexp(lambda)`	$\lambda e^{-\lambda x}$	$1/\lambda$	$1/\lambda^2$
(10) Gamma	`x ~ dgamma(a, b)`	$b^a x^{a-1}e^{-bx}/\Gamma(a)$	a/b	a/b^2
(11) Generalized gamma	`x ~ gen.gamma(a, b, r)`	$rb(bx)^{ra-1}\exp\left[-(bx)^r\right]/\Gamma(a)$	$\Gamma(a+1/r)/[b\Gamma(a)]$	$[\Gamma(a+2/r^2)\Gamma(a)-\Gamma(a+1/r)^2]/[\lambda\Gamma(a)]^2$
(12) Log-normal	`x ~ dlnorm(mu, tau)`	$\sqrt{\tau/(2\pi)}x^{-1}\exp\left[-\tau/2(\log x-\mu)^2\right]$	$e^{\mu+1/(2\tau)}$	$(e^{1/\tau}-1)e^{2\mu+1/\tau}$
(13) Logistic	`x ~ dlogis(mu, tau)`	$\tau e^{\tau(x-\mu)}\left[1+e^{\tau(x-\mu)}\right]^{-2}$	μ	$\pi^2/[3\tau^2]$
(14) Normal	`x ~ dnorm(mu, tau)`	$\sqrt{\tau/(2\pi)}\exp[-\tau(x-\mu)^2/2]$	μ	$1/\tau$
(15) Pareto	`x ~ dpar(a, c)`	$ac^a x^{-a-1}$	$ab/(a-1)$	$ab^2/[(a-1)^2(a-2)]$
(16) Student's t	`x ~ dt(mu, tau, v)`	$\Gamma[(v+1)/2]\sqrt{\tau/(2\pi)}[\Gamma(v/2)]^{-1}$ $\times\left[1+\tau v^{-1}(x-\mu)^2\right]^{-(v+1)/2}$	μ	$v\tau^{-1}/(v-2)$
(17) Uniform	`x ~ dunif(a, b)`	$1/(b-a)$	$a/(a+b)$	$\frac{1}{12}(b-a)^2$
(18) Weibull	`x ~ dweib(v, lambda)`	$v\lambda x^{v-1}\exp(-\lambda x^v)$	$\lambda^{-1/v}\Gamma\left(1+v^{-1}\right)$	$\left[\Gamma\left(1+2v^{-1}\right)-\Gamma\left(1+v^{-1}\right)^2\right]\lambda^{-2/v}$

Key: $p \in (0,1)$; **(1)** $x = 0, 1$; **(2)** $x = 0, 1\ldots, n$, $p \in (0,1)$; **(3)** $p[\,]$ is a vector of dimension K, $x = 1, 2, \ldots, K$ and elements $p[x] = p_x \in (0,1)$, $\sum_{x=1}^{K} p_x = 1$; **(4)** $x = 0, 1, 2, \ldots$; $r = 1, 2, \ldots$; **(5)** $x = 0, 1, 2, \ldots$; $\lambda > 0$; **(6)** $x \in (0,1)$, $a, b > 0$; **(8)** $x \in \mathbf{R}$, $\mu \in \mathbf{R}$, $\tau > 0$; **(9)** $x > 0$, $\lambda > 0$; **(10, 11)** $x > 0$, $a, b, r > 0$; **(12)** $x > 0$, $\mu \in \mathbf{R}$, $\tau > 0$; **(13, 14, 16)** $x \in \mathbf{R}$, $\mu \in \mathbf{R}$, $\tau, v > 0$; **(15)** $x > c$, $a, c > 0$; **(17)** $x \in (a,b)$, $a, b \in \mathbf{R}$, $a < b$; **(18)** $x > 0$, $v, \lambda > 0$.