Distribution	Notation	Parameters	Density function	Mean, variance, and mode
Student-t	$\theta \sim t_\nu(\mu, \sigma^2)$ $p(\theta)=t_\nu(\theta\|\mu, \sigma^2)$ t_ν is short for $t_\nu(0, 1)$	degrees of freedom ν>0 location μ scale σ>0	$p(\theta) = \frac{\Gamma((\nu+1)/2)}{\Gamma(\nu/2)\sqrt{\nu\pi}\sigma}(1+\frac{1}{\nu}(\frac{\theta-\mu}{\sigma})^2)^{-(\nu+1)/2}$	$E(\theta)=\mu$, for $\nu>1$ $var(\theta)=\frac{\nu}{\nu-2}\sigma^2$, for $\nu>2$ $mode(\theta)=\mu$
Multivariate Student-t	$\theta \sim t_\nu(\mu, \Sigma)$ $p(\theta)=t_\nu(+\|\mu, \Sigma)$ (implicit dimension d)	degrees of freedom ν>0 location $\mu=(\mu_1,\ldots,\mu_d)$ symmetric, pos. definite $d\times$d scale matrix Σ	$p(\theta) = \frac{\Gamma((\nu+d)/2)}{\Gamma(\nu/2)\nu^{d/2}\pi^{d/2}}\|\Sigma\|^{-1/2}$ $\times(1+\frac{1}{\nu}(\theta-\mu)^T\Sigma^{-1}(\theta-\mu))^{-(\nu+d)/2}$	$E(\theta)=\mu$, for $\nu>1$ $var(\theta)=\frac{\nu}{\nu-2}\Sigma$, for $\nu>2$ $mode(\theta)=\mu$
Beta	$\theta \sim Beta(\alpha, \beta)$ $p(\theta)=Beta(\theta\|\alpha, \beta)$	'prior sample sizes' α>0, β>0	$p(\theta)=\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}\theta^{\alpha-1}(1-\theta)^{\beta-1}$ $\theta\in[0,1]$	$E(\theta)=\frac{\alpha}{\alpha+\beta}$ $var(\theta)=\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$ $mode(\theta)=\frac{\alpha-1}{\alpha+\beta-2}$
Dirichlet	$\theta \sim Dirichlet(\alpha_1,\ldots,\alpha_k$ $p(\theta)$ $=Dirichlet(\theta\|\alpha_1,\ldots,\alpha_k)$	'prior sample sizes' $\alpha_j>0$; $\alpha_0\equiv\sum_{j=1}^k\alpha_j$	$p(\theta)=\frac{\Gamma(\alpha_1+\cdots+\alpha_k)}{\Gamma(\alpha_1)\cdots\Gamma(\alpha_k)}\theta_1^{\alpha_1-1}\cdots\theta_k^{\alpha_k-1}$ $\theta_1,\ldots,\theta_k\geq 0; \sum_{j=1}^k\theta_j=1$	$E(\theta_j)=\frac{\alpha_j}{\alpha_0}$ $var(\theta_j)=\frac{\alpha_j(\alpha_0-\alpha_j)}{\alpha_0^2(\alpha_0+1)}$ $cov(\theta_i,\theta_j)=-\frac{\alpha_i\alpha_j}{\alpha_0^2(\alpha_0+1)}$ $mode(\theta_j)=\frac{\alpha_j-1}{\alpha_0-k}$

Table A.2 Discrete distributions

Distribution	Notation	Parameters	Density function	Mean, variance, and mode
Poisson	$\theta \sim Poisson(\lambda)$ $p(\theta)=Poisson(\theta\|\lambda)$	'rate' λ>0	$p(\theta)=\frac{1}{\theta!}\lambda^\theta\exp(-\lambda)$ $\theta=0,1,2,\ldots$	$E(\theta)=\lambda$, $var(\theta)=\lambda$ $mode(\theta)=\lfloor\lambda\rfloor$
Binomial	$\theta \sim Bin(n, p)$ $p(\theta)=Bin(\theta\|n, p)$	'sample size' n (positive integer] 'probability' p□[0, 1]	$p(\theta)=\binom{n}{\theta}p^\theta(1-p)^{n-\theta}$ $\theta=0,1,2,\ldots,n$	$E(\theta)=np$ $var(\theta)=np(1-p)$ $mode(\theta)=\lfloor(n+1)p\rfloor$
Multinomial	$\theta \sim Multin(n; p_1 \ldots p_k)$ $p(\theta)$ _$Multin(\theta\|n;p_1\ldots p_k)$	'sample size' n (positive integer) 'probabilities' p_j□[0, 1]$\sum_{j=1}^k p_j=1$	$p(\theta)=\binom{n}{\theta_1\ \theta_2\cdots\theta_k}p_1^{\theta_1}\cdots p_k^{\theta_k}$ $\theta_j=0,1,2,\ldots,n; \sum_{j=1}^k\theta_j=n$	$E(\theta_j)=np_j$ $var(\theta_j)=np_j(1-p_j)$ $cov(\theta_i,\theta_j)=-np_ip_j$
Negative binomial	$\theta \sim Neg\text{-}bin(\alpha, \beta)$ $p(\theta)=Neg\text{-}bin(\theta\|\alpha,\beta)$	shape α>0 inverse scale β>0	$p(\theta)=\binom{\theta+\alpha-1}{\alpha-1}\left(\frac{\beta}{\beta+1}\right)^\alpha\left(\frac{1}{\beta+1}\right)^\theta$ $\theta=0,1,2,\ldots$	$E(\theta)=\frac{\alpha}{\beta}$ $var(\theta)=\frac{\alpha}{\beta^2}(\beta+1)$
Betabinomial	$\theta \sim Beta\text{-}bin(n, \alpha, \beta)$ $p(\theta)=Beta\text{-}bin(\theta\|n, \alpha, \beta)$	'sample size' n (positive integer 'prior sample sizes' α>0, β>0	$p(\theta)=\frac{\Gamma(n+1)}{\Gamma(\theta+1)\Gamma(n-\theta+1)}\frac{\Gamma(a+\theta)\Gamma(n+b-\theta)}{\Gamma(a+b+n)}$ $\times\frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)}$, $\theta=0,1,2,\ldots,n$	$E(\theta)=n\frac{\alpha}{\alpha+\beta}$ $var(\theta)=n\frac{\alpha\beta(\alpha+\beta+n)}{(\alpha+\beta)^2(\alpha+\beta+1)}$

Table A.1 Continuous distributions

Distribution	Notation	Parameters	Density function	Mean, variance, and mode
Uniform	$\theta \sim \mathrm{U}(a, b)$ $p(\theta)=U(\theta/a, b)$	boundaries a, b with $b>a$	$p(\theta) = \frac{1}{b-a}, \ \theta \in [a, b]$	$\mathrm{E}(\theta) = \frac{a+b}{2}$, $\mathrm{var}(\theta) = \frac{(b-a)^2}{12}$ no mode
Normal	$\theta \sim N(\mu, \sigma^2)$ $p(\theta)=N(\theta/\mu, \sigma^2)$	location μ scale $\sigma>0$	$p(\theta) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{1}{2\sigma^2}(\theta-\mu)^2\right)$	$\mathrm{E}(\theta) = \mu$, $\mathrm{var}(\theta) = \sigma^2$ $\mathrm{mode}(\theta) = \mu$
Multivariate normal	$\theta \sim N(\mu, \Sigma)$ $p(\theta)=\mathrm{N}(\theta/\mu, \Sigma)$ (implicit dimension d)	symmetric, pos. definite, $d \times d$ variance matrix Σ	$p(\theta) = (2\pi)^{-d/2}\lvert\Sigma\rvert^{-1/2}$ $\times \exp\left(-\frac{1}{2}(\theta-\mu)^T\Sigma^{-1}(\theta-\mu)\right)$	$\mathrm{E}(\theta) = \mu$, $\mathrm{var}(\theta) = \Sigma$ $\mathrm{mode}(\theta) = \mu$
Gamma	$\theta \sim \mathrm{Gamma}(\alpha, \beta)$ $p(\theta)=\mathrm{Gamma}(\theta/\alpha, \beta)$	shape $\alpha>0$ inverse scale $\beta>0$	$p(\theta) = \frac{\beta^\alpha}{\Gamma(\alpha)}\theta^{\alpha-1}e^{-\beta\theta}, \ \theta>0$	$\mathrm{E}(\theta) = \frac{\alpha}{\beta}$ $\mathrm{var}(\theta) = \frac{\alpha}{\beta^2}$ $\mathrm{mode}(\theta) = \frac{\alpha-1}{\beta}$, for $\alpha \geq 1$
Inversegamma	$\theta \sim \mathrm{Inv\text{-}gamma}(\alpha, \beta)$ $p(\theta)=\mathrm{Inv\text{-}gamma}(\theta/\alpha, \beta)$	shape $\alpha>0$ scale $\beta>0$	$p(\theta) = \frac{\beta^\alpha}{\Gamma(\alpha)}\theta^{-(\alpha+1)}e^{-\beta/\theta}, \ \theta>0$	$\mathrm{E}(\theta) = \frac{\beta}{\alpha-1}$, for $\alpha > 1$ $\mathrm{var}(\theta) = \frac{\beta^2}{(\alpha-1)^2(\alpha-2)}, \alpha>2$ $\mathrm{mode}(\theta) = \frac{\beta}{\alpha+1}$
Chi-square	$\theta \sim \chi^2_\nu$ $p(\theta) = \chi^2_\nu(\theta)$	degrees of freedom $\nu>0$	$p(\theta) = \frac{2^{-\nu/2}}{\Gamma(\nu/2)}\theta^{\nu/2-1}e^{-\theta/2}, \ \theta>0$ same as $\mathrm{Gamma}(\alpha = \frac{\nu}{2}, \beta = \frac{1}{2})$	$\mathrm{E}(\theta) = \nu$, $\mathrm{var}(\theta) = 2\nu$ $\mathrm{mode}(\theta) = \nu-2$, for $\nu \geq 2$
Inversechi-square	$\theta \sim \mathrm{Inv\text{-}}\chi^2_\nu$ $p(\theta) = \mathrm{Inv\text{-}}\chi^2_\nu(\theta)$	degrees of freedom $\nu>0$	$p(\theta) = \frac{2^{-\nu/2}}{\Gamma(\nu/2)}\theta^{-(\nu/2+1)}e^{-1/(2\theta)}, \ \theta > 0$ same as $\mathrm{Inv\text{-}gamma}(\alpha = \frac{\nu}{2}, \beta = \frac{1}{2})$	$\mathrm{E}(\theta) = \frac{1}{\nu-2}$, for $\nu > 2$ $\mathrm{var}(\theta) = \frac{2}{(\nu-2)^2(\nu-4)}, \nu>4$ $\mathrm{mode}(\theta) = \frac{1}{\nu+2}$
Scaled inversechi-square	$(\theta \sim \mathrm{Inv\text{-}}\chi^2(\nu, s^2)$ $p(\theta)=\mathrm{Inv\text{-}}\chi^2(\theta/\nu, s^2)$	degrees of freedom $\nu>0$ scale $s>0$	$p(\theta) = \frac{(\nu/2)^{\nu/2}}{\Gamma(\nu/2)}s^\nu\theta^{-(\nu/2+1)}e^{-\nu s^2/(2\theta)}, \ \theta>0$ same as $\mathrm{Inv\text{-}gamma}(\alpha = \frac{\nu}{2}, \beta = \frac{\nu}{2}s^2)$	$\mathrm{E}(\theta) = \frac{\nu}{\nu-2}s^2$ $\mathrm{var}(\theta) = \frac{2\nu^2}{(\nu-2)^2(\nu-4)}s^4$ $\mathrm{mode}(\theta) = \frac{\nu}{\nu+2}s^2$
Exponential	$\theta \sim \mathrm{Expon}(\beta)$ $p(\theta)$–$\mathrm{Expon}(\theta/\beta)$	inverse scale $\beta>0$	$p(\theta) = \beta e^{-\beta\theta}, \ \theta>0$ same as $\mathrm{Gamma}(\alpha = 1, \beta)$	$\mathrm{E}(\theta) = \frac{1}{\beta}$, $\mathrm{var}(\theta) = \frac{1}{\beta^2}$ $\mathrm{mode}(\theta) = 0$
Wishart	$W \sim \mathrm{Wishart}\nu(S)$ $p(W)=\mathrm{Wishart}_\nu(W/S)$ (implicit dimension $k \times k$)	degrees of freedom ν symmetric, pos. definite $k \times k$ scale matrix S	$p(W) = \left(2^{\nu k/2}\pi^{k(k-1)/4}\prod_{i=1}^k \Gamma\left(\frac{\nu+1-i}{2}\right)\right)^{-1}$ $\times \lvert S\rvert^{-\nu/2}\lvert W\rvert^{(\nu-k-1)/2}$ $\times \exp\left(-\frac{1}{2}\mathrm{tr}(S^{-1}W)\right)$, W pos. definite	$\mathrm{E}(W) = \nu S$
InverseWishart	$W \sim \mathrm{Inv\text{-}Wishart}_\nu(S^{-1})$ $p(W)=\mathrm{Inv\text{-}Wishart}_\nu(W/S^{-1})$ (implicit dimension $k \times k$)	degrees of freedom ν symmetric, pos. definite $k \times k$ scale matrix S	$p(W) = \left(2^{\nu k/2}\pi^{k(k-1)/4}\prod_{i=1}^k \Gamma\left(\frac{\nu+1-i}{2}\right)\right)^{-1}$ $\times \lvert S\rvert^{\nu/2}\lvert W\rvert^{-(\nu+k+1)/2}$ $\times \exp\left(-\frac{1}{2}\mathrm{tr}(SW^{-1})\right)$, W pos. definite	$\mathrm{E}(W) = (\nu-k-1)^{-1}S$