Hazard Rates, Survival Functions, Probability Density Functions, and Expected Lifetimes for Some Common Parametric Distributions

Distribution	*Hazard Rate* $h(x)$	*Survival Function* $S(x)$	*Probability Density Function* $f(x)$	*Mean* $E(X)$
Exponential $\lambda > 0,\ x \geq 0$	λ	$\exp[-\lambda x]$	$\lambda \exp(-\lambda x)$	$\frac{1}{\lambda}$
Weibull $\alpha, \lambda > 0,$ $x \geq 0$	$\alpha\lambda x^{\alpha-1}$	$\exp[-\lambda x^{\alpha}]$	$\alpha\lambda x^{\alpha-1} \exp(-\lambda x^{\alpha})$	$\frac{\Gamma(1 + 1/\alpha)}{\lambda^{1/\alpha}}$
Gamma $\beta, \lambda > 0,$ $x \geq 0$	$\frac{f(x)}{S(x)}$	$1 - I(\lambda x, \beta)^{*}$	$\frac{\lambda^{\beta} x^{\beta-1} \exp(-\lambda x)}{\Gamma(\beta)}$	$\frac{\beta}{\lambda}$
Log normal $\sigma > 0, x \geq 0$	$\frac{f(x)}{S(x)}$	$1 - \Phi\left[\frac{1\text{n}x - \mu}{\sigma}\right]$	$\frac{\exp\left[-\frac{1}{2}\left(\frac{1\text{n}x-\mu}{\sigma}\right)^2\right]}{x(2\pi)^{1/2}\sigma}$	$\exp(\mu + 0.5\sigma^2)$
Log logistic $\alpha, \lambda > 0, x \geq 0$	$\frac{\alpha x^{\alpha-1}\lambda}{1 + \lambda x^{\alpha}}$	$\frac{1}{1 + \lambda x^{\alpha}}$	$\frac{\alpha x^{\alpha-1}\lambda}{[1 + \lambda x^{\alpha}]^2}$	$\frac{\pi\text{Csc}(\pi/\alpha)}{\alpha\lambda^{1/\alpha}}$ if $\alpha > 1$
Normal $\sigma > 0,$ $-\infty < x < \infty$	$\frac{f(x)}{S(x)}$	$1 - \Phi\left[\frac{x-\mu}{\sigma}\right]$	$\frac{\exp\left[-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right]}{(2\pi)^{1/2}\sigma}$	μ
Exponential power $\alpha, \lambda > 0, x \geq 0$	$\alpha\lambda^{\alpha} x^{\alpha-1} \exp\{[\lambda x]^{\alpha}\}$	$\exp\{1 - \exp[(\lambda x)^{\alpha}]\}$	$\alpha e \lambda^{\alpha} x^{\alpha-1} \exp[(\lambda x)^{\alpha}] - \exp\{\exp[(\lambda x)^{\alpha}]\}$	$\int_0^{\infty} S(x)dx$
Gompertz $\theta, \alpha > 0, x \geq 0$	$\theta e^{\alpha x}$	$\exp\left[\frac{\theta}{\alpha}(1 - e^{\alpha x})\right]$	$\theta e^{\alpha x} \exp\left[\frac{\theta}{\alpha}(1 - e^{\alpha x})\right]$	$\int_0^{\infty} S(x)dx$
Inverse Gaussian $\lambda \geq 0, x \geq 0$	$\frac{f(x)}{S(x)}$	$\Phi\left[\left(\frac{\lambda}{x}\right)^{1/2}\left(1 - \frac{x}{\mu}\right)\right] - e^{2\lambda/\mu}\Phi\left\{-\left[\frac{\lambda}{x}\right]^{1/2}\left(1 + \frac{x}{\mu}\right)\right\}$	$\left(\frac{\lambda}{2\pi x^3}\right)^{1/2} \exp\left[\frac{\lambda(x-\mu^2)}{2\mu^2 x}\right]$	μ
Pareto $\theta > 0, \lambda > 0$ $x \geq \lambda$	$\frac{\theta}{x}$	$\frac{\lambda^{\theta}}{x^{\theta}}$	$\frac{\theta\lambda^{\theta}}{x^{\theta+1}}$	$\frac{\theta\lambda}{\theta - 1}$ if $\theta > 1$
Generalized gamma $\lambda > 0, \alpha > 0,$ $\beta > 0, x \geq 0$	$\frac{f(x)}{S(x)}$	$1 - I[\lambda x^{\alpha}, \beta]$	$\frac{\alpha\lambda^{\beta} x^{\alpha\beta-1} \exp(-\lambda x^{\alpha})}{\Gamma(\beta)}$	$\int_0^{\infty} S(x)dx$

* $I(t, \beta) = \int_0^t u^{\beta-1} \exp(-u)du/\Gamma(\beta)$.