Discrete Probability Distributions

Name	Parameters	Support	PMF	CDF	MGF	$\boldsymbol{E}[\boldsymbol{X}]$	$\boldsymbol{V}[\boldsymbol{X}]$
Bernoulli	$p \in [0,1]$	$x \in \{0,1\}$	$\begin{cases} p, & \text{if } x = 1 \\ 1-p, & \text{if } x = 0 \end{cases}$	$\begin{cases} 0, & \text{if } x < 0 \\ 1-p, & \text{if } 0 \leq x < 1 \\ 1, & \text{if x} \geq 1 \end{cases}$	$(1-p) + pe^t$	p	$p(1-p)$
Binomial $X \sim BIN(n,p)$	$n \in \{0,1,\dots\}$ $p \in [0,1]$	$x \in \{0,\dots,n\}$	$\binom{n}{x} p^x (1-p)^{n-x}$	-	$(1-p+pe^t)^n$	np	$np(1-p)$
Geometric $X \sim GEO(p)$	$p \in (0,1]$	$x \in \{0,\dots\}$	$(1-p)^x p$	$1-(1-p)^{x+1}$	$\frac{p}{1-(1-p)e^t}$	$\frac{1-p}{p}$	$\frac{1-p}{p^2}$
Negative Binomial $X \sim NB(n,p)$	$n = \{1,\dots\}$ $p \in (0,1)$	$x \in \{0,\dots\}$	$\binom{n+x-1}{n-1} (1-p)^x p^n$	-	$\left(\frac{p}{1-(1-p)e^t}\right)^n$	$\frac{n(1-p)}{p}$	$\frac{n(1-p)}{p^2}$
Poisson $X \sim POI(\lambda)$	$\lambda > 0$	$x \in \{0,\dots\}$	$\frac{\lambda^x e^{-\lambda}}{x!}$	-	$\exp[\lambda(e^t - 1)\,]$	λ	λ

Continuous Probability Distributions

Name	Parameters	Support	PDF	CDF	MGF	$E[X]$	$V[X]$
Uniform $X \sim U(\alpha,\beta)$	$\alpha < \beta$	$x \in [\alpha,\beta]$	$\frac{1}{\beta-\alpha}$	$\frac{x-\alpha}{\beta-\alpha}$	$\begin{cases} \frac{e^{t\beta}-e^{t\alpha}}{t(\beta-\alpha)}, t \neq 0 \\ 1, \ t=0 \end{cases}$	$\frac{1}{2}(\alpha+\beta)$	$\frac{1}{12}(\beta-\alpha)^2$
Exponential $X \sim EXP(\lambda)$	$\lambda \in (0,\infty)$	$x \in [0,\infty)$	$\lambda e^{-\lambda x}$	$1-e^{-\lambda x}$	$\frac{\lambda}{\lambda - t}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$
Gamma $X \sim GAMMA(\alpha,\lambda)$	$\alpha \in (0,\infty)$ $\lambda \in (0,\infty)$	$x \in (0,\infty)$	$\frac{\lambda^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\lambda x}$	-	$\left(1-\frac{t}{\lambda}\right)^{-\alpha}$	$\frac{\alpha}{\lambda}$	$\frac{\alpha}{\lambda^2}$
Chi-Square $X \sim \chi^2(k)$	$k = \{1,2,\ldots\}$	$x \in [0,\infty)$	$\frac{x^{\left(\frac{k}{2}-1\right)} e^{\left(-\frac{x}{2}\right)}}{2^{\left(\frac{k}{2}\right)} \Gamma\left(\frac{k}{2}\right)}$	-	$(1-2t)^{\left(-\frac{k}{2}\right)}$	k	$2k$
Standard Normal $X \sim N(0,1)$	-	$x \in (-\infty,\infty)$	$\frac{1}{\sqrt{2\pi}} \exp\left[-\frac{x^2}{2}\right]$	-	$\exp\left[\frac{t^2}{2}\right]$	0	1
Normal $X \sim N(\mu,\sigma^2)$	$\mu \in (-\infty,\infty)$ $\sigma \in (0,\infty)$	$x \in (-\infty,\infty)$	$\frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{(x-\mu)^2}{2\sigma^2}\right]$	-	$\exp\left[\mu t + \frac{\sigma^2 t^2}{2}\right]$	μ	σ^2
Log-Normal	$\mu \in (-\infty,\infty)$ $\sigma \in (0,\infty)$	$x \in (0,\infty)$	$\frac{1}{x\sigma\sqrt{2\pi}} \exp\left[-\frac{(\ln x-\mu)^2}{2\sigma^2}\right]$	-	-	$\exp\left[\mu + \frac{\sigma^2}{2}\right]$	$(e^{\sigma^2}-1)\exp(2\mu+\sigma^2)$

Where $\Gamma(t) = \int_0^\infty x^{t-1} e^{-x} dx$ for $t > 0$.