Distribution	What it Represents	PMF / PDF	CDF	E[X]	Var[X]
Bernoulli	Binary trial (success/failure)	$P(1) = p,\ P(0) = 1 - p$	$\begin{cases} 0 & x < 0 \\ 1-p & 0 \leq x < 1 \\ 1 & x \geq 1 \end{cases}$	p	$p(1-p)$
Binomial	Successes in n trials	$\binom{n}{k} p^k (1-p)^{n-k}$	$\sum_{i=0}^{k} \binom{n}{i} p^i (1-p)^{n-i}$	np	$np(1-p)$
Geometric	Trials until 1st success	$(1-p)^{k-1} p$	$1 - (1-p)^k$	$1/p$	$(1-p)/p^2$
Neg. Binomial	Trials until r^{th} success	$\binom{k-1}{r-1} p^r (1-p)^{k-r}$	—	r/p	$r(1-p)/p^2$
Hypergeometric	k successes in n draws without replacement	$\frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}$	—	$n \cdot \frac{K}{N}$	$n \frac{K}{N} \frac{N-K}{N} \frac{N-n}{N-1}$
Neg. Hypergeometric	Trials until r^{th} success without replacement	$\frac{\binom{k-1}{r-1}\binom{N-k}{n-r}}{\binom{N}{n}}$	—	$\frac{r(N+1)}{K+1}$	$\frac{r(N-K)(N+1-r)}{(K+1)^2(K+2)}$
Poisson	Event count in interval	$\frac{\lambda^k e^{-\lambda}}{k!}$	$\sum_{i=0}^{k} \frac{\lambda^i e^{-\lambda}}{i!}$	λ	λ
Uniform (Cont.)	Even distribution over $[a, b]$	$\frac{1}{b-a}$	$\frac{x-a}{b-a},\ x \in [a, b]$	$(a+b)/2$	$(b-a)^2/12$
Exponential	Time between Poisson events	$\lambda e^{-\lambda x},\ x \geq 0$	$1 - e^{-\lambda x}$	$1/\lambda$	$1/\lambda^2$
Normal (Gaussian)	Symmetric about mean μ	$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$	$\Phi\left(\frac{x-\mu}{\sigma}\right)$	μ	σ^2
Gamma	Waiting time for k Poisson events	$\frac{\lambda^k x^{k-1} e^{-\lambda x}}{\Gamma(k)}$	—	k/λ	k/λ^2
Beta	Probabilities in $[0, 1]$	$\frac{x^{\alpha-1}(1-x)^{\beta-1}}{B(\alpha,\beta)}$	—	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$
Chi-Square	Sum of k squared normals	$\frac{1}{2^{k/2}\Gamma(k/2)} x^{k/2-1} e^{-x/2}$	—	k	$2k$
Student's t	Normal with unknown variance	$\frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\nu\pi}\,\Gamma\left(\frac{\nu}{2}\right)} \left(1 + \frac{x^2}{\nu}\right)^{-(\nu+1)/2}$	—	0 (if $\nu > 1$)	$\frac{\nu}{\nu-2}$ (if $\nu > 2$)

Table 1: Common Probability Distributions with PMF/PDF, CDF, Mean, and Variance