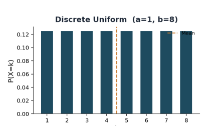
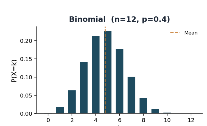
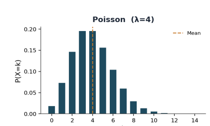
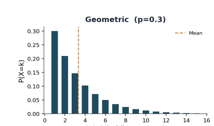
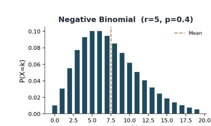
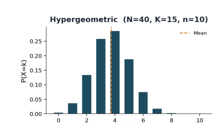
Discrete Random Variables — *Quick Reference Table*

Feature	DiscreteUniform	Binomial	Poisson	Geometric	NegativeBinomial	Hypergeometric
Notation	$X \sim DU(a, b)$	$X \sim B(n, p)$	$X \sim Poisson(\lambda)$	$X \sim Geometric(p)$	$X \sim NB(r, p)$	$X \sim Hyper(N, K, n)$
PMF P(X = k)	$\frac{1}{b-a+1}$	$C_{n,k}\, p^k (1-p)^{n-k}$	$e^{-\lambda} \frac{\lambda^k}{k!}$	$(1-p)^{k-1} p$	$C_{k+r-1,k}\, p^r (1-p)^k$	$\frac{C_{K,k} \cdot C_{N-K,n-k}}{C_{N,n}}$
Support	$k = a, \ldots, b$	$k = 0, 1, \ldots, n$	$k = 0, 1, 2, \ldots$	$k = 1, 2, 3, \ldots$	$k = 0, 1, 2, \ldots$	$max(0, n-N+K) \ldots min(n,K)$
Parameters	a, b (integers)	n trials, p = P(success)	λ = rate (λ > 0)	p = P(success)	r = # successes, p = P(success)	N pop., K successes, n sample
Mean μ	$\frac{a+b}{2}$	np	λ	$\frac{1}{p}$	$\frac{r(1-p)}{p}$	$\frac{nK}{N}$
Variance σ²	$\frac{[(b-a+1)^2-1]}{12}$	$np(1-p)$	λ	$\frac{1-p}{p^2}$	$\frac{r(1-p)}{p^2}$	$\frac{n(K/N)(1-K/N)(N-n)}{N-1}$
Std. Dev. σ	$\sqrt{Variance}$	$\sqrt{np(1-p)}$	$\sqrt{\lambda}$	$\frac{\sqrt{1-p}}{p}$	$\frac{\sqrt{r(1-p)}}{p}$	$\sqrt{Variance}$
Median / Mode	$\frac{a+b}{2}$ · no unique mode	$\approx \lfloor np \rfloor$ · mode $\lfloor (n+1)p \rfloor$	$\approx \lfloor \lambda + 1/3 - 0.02/\lambda \rfloor$ · mode $\lfloor \lambda \rfloor$	$\lceil \ln 0.5 / \ln(1-p) \rceil$ · mode 1	no closed form · mode $\lfloor (r-1)(1-p)/p \rfloor$	no closed form
Skewness	0 (symmetric)	$\frac{1-2p}{\sqrt{np(1-p)}}$	$\frac{1}{\sqrt{\lambda}}$	$\frac{2-p}{\sqrt{1-p}}$	$\frac{2-p}{\sqrt{r(1-p)}}$	complex; ≈0 for large N
Shape						
Used For	Fair die; equally likely draws	# successes in n trials (w/ replacement)	# events per interval of time/space	# trials until 1st success	# failures before r-th success	Sampling without replacement
Notes	Simplest discrete dist.; continuous analogue is Uniform(a,b)	Sum of n Bernoulli(p); ≈ Poisson(λ=np) if n large, p small	Mean = Variance (signature property); limit of Binomial as n→∞	Memoryless: P(X>m+n|X>m) =P(X>n); special case of NB with r=1	Generalized Geometric (r=1); good for overdispersed data (Var>Mean)	Unlike Binomial: sampling WITHOUT replacement; →Binomial(n,K/N) as N→∞