sample(x, size, replace = FALSE, prob = NULL)	sum(numbers == x) to count	$P(A \cap B) = P(A \mid B) \cdot P(B)$ (dep) $P(A) \cdot P(B)$ (ind)

$P(A) = \sum_n P(A \cap B_n)$	$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$	CDF: $P(X \le x) = \sum_{y \le x} P(X = y)$ or $\int_{-\infty}^{x} f_X(y)\,dy$	$E[X] = \sum_i a_i\, p(a_i)$ or $\int_{-\infty}^{\infty} x f(x)\,dx$

$Var(X) = E[X^2] - (E[X])^2$	MGF: $M_X(t) = E[e^{tX}] = \sum_k e^{tk} p_X(k)$ or $\int_{-\infty}^{\infty} e^{tk} f_X(k)\,dk$

Name	Not	Params	PMF/PDF	CDF	Mean	Variance	MGF	R	Sentence
Disc Unif	Unif(a,b)	a - first num b - last num n - # outcomes	$\frac{1}{n}$	$\frac{\lfloor k \rfloor - a + 1}{n}$	$\frac{a+b}{2}$	$\frac{n^2-1}{12}$	$\frac{e^{at} - e^{(b+1)t}}{n(1-e^t)}$	N/A	Die (fair) rolled
Bern	Bern(p)	p - prob	$p^k(1-p)^{1-k}$	0 for $0 > k$ $1-p$ for $0 \le k \le 1$ 〃 $k \ge 1$	p	$p(1-p)$	$(1-p) + pe^t$	bern	Coin, want heads $p = 0.5$
Binomial	B(n,p)	n - trials p - prob suc.	$\binom{n}{k} p^k (1-p)^{n-k}$	—	np	$np(1-p)$	$((1-p) + pe^t)^n$	binom	prob 3 heads if I flip fair coin 5 times ($n = 5$, $k = 3$, $p = 0.5$)
Geom.	Geo(p)	p - prob	$(1-p)^{k-1} p$	$1 - (1-p)^{\lfloor k \rfloor + 1}$ for $k \ge 1$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\frac{pe^t}{1-(1-p)e^t}$ for $t < -\ln(1-p)$	geom	prob I get heads after flipping coin exactly 2 times ($p = 0.5$, $k = 2$)
~~Neg. Binom~~	~~NB(r,p)~~	~~r - desired # of successes~~ ~~p - prob~~	$\cancel{\binom{k-1}{r-1} p^{r-1} (1-p)^{(k-1)-(r-1)}}$	~~no CDF →~~	$\cancel{\frac{r(1-p)}{p}}$	$\cancel{\frac{r(1-p)}{p^2}}$	$\cancel{\left(\frac{p}{1-(1-p)e^t}\right)^r}$ ~~for $t < -\log(1-p)$~~	~~nbinom~~	~~prob I get 3 heads within 5 coin flips ($r = 3$, $k = 5$, $p = 0.5$)~~
Hyper-geom	H(N,b,n)	N - total size b - size (success) n - sample size	$\frac{\binom{b}{k} \cdot \binom{N-b}{n-k}}{\binom{N}{n}}$		$n \cdot \frac{b}{N}$	$n \cdot \frac{b}{N} \cdot \frac{N-b}{N} \cdot \frac{N-n}{N-1}$		hyper	6 docs, 19 nurses. all names put in hat and 5 selected no replacement. Prob 4 docs and 1 nurse picked ($N = 25$, $n = 5$, $b = 6$, $k = 4$)
Poisson	Pois(λ)	λ - rate	$\frac{\lambda^k e^{-\lambda}}{k!}$		λ	λ	$\exp[\lambda(e^t - 1)]$	pois	1 ng of plutonium has 2.3 decays/sec. prob that there are exactly 3 decays in 2 secs ($\lambda = 2.3 \times 2$, $k = 3$)
Cont. Unif.	Unif(a,b)	a - lower bnd b - upper bnd	$\frac{1}{b-a}$, $k \in [a,b]$	$\frac{k-a}{b-a}$, $k \in [a,b]$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	$\frac{e^{tb} - e^{ta}}{t(b-a)}$, $t \ne 0$ 1, $t = 0$	unif	waiting for bus that comes hourly and you don't know when it came last ($a = 0$, $b = 1$ in hours)
Exp	Exp(λ)	λ - rate	$\lambda e^{-\lambda k}$	$1 - e^{-\lambda k}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\frac{\lambda}{\lambda - t}$, $t < \lambda$	exp	prob that something burns out in 3 secs given it averagely burns out in 5 secs ($\lambda = 5$, $k = 3$)
Normal (norm)	$N(u, \sigma^2)$	u - avg σ^2 - variance	$\frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{k-u}{\sigma}\right)^2}$		u	σ^2	$\exp(ut + \frac{\sigma^2 t^2}{2})$		average height of pop. is 5 ft, std is 0.5. prob someone is 5.1 feet ($u = 5$, $\sigma = 0.5$, $k = 5.1$)

d - PMF p - CDF q - quantile r - vector of exp, each elem is # of success	d(k ...) p(quantile ...) q(cdf value) r(trials ...)	bern(... p ...) binom(... n, p ...) geom(... p ...) nbinom(... r, p ...)	hyper(... b, N-b, n, $\frac{b}{N}$ ...) pois(... λ ...) unif(... a, b ...) exp(... λ ...) norm(... u, σ ...)

lower.tail = FALSE $[P(X \le k)]$
〃 TRUE $[P(X > k)]$

Name	Not	Params	PMF/PDF	CDF	Mean	Variance	MGF	Sentence
Neg. Binom	NB(r,p)	r - desired # of successes p - prob	$\binom{k-1}{r-1} p^r (1-p)^{k-r}$		$\frac{r}{p}$	$\frac{r(1-p)}{p^2}$	$\frac{(pe^t)}{[1 - e^t(1-p)]^r}$	prob I get 3 heads within 5 fair coin flips ($r = 3$, $k = 5$, $p = 0.5$)

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