Stat 343: Common Discrete Distributions

Bernoulli(p)

X = the result of a single experiment with one of two outcomes ("success", coded as 1, or "failure", coded as 0), where the probability of success is p.

parameters	p = probability of success
p.f.	$f(x\|p) = p^x(1-p)^{(1-x)}$
Mean	p
Variance	$p(1-p)$

Binomial(n, p)

X = the total number of successes in n independent and identically distributed Bernoulli trials, each with probability of success p.

parameters	n = number of trials, p = probability of success
p.f.	$f(x\|n, p) = \binom{n}{x} p^x(1-p)^{(n-x)}$
Mean	np
Variance	$np(1-p)$

Uniform(a, b)

X = an integer between a and b (inclusive), where each integer from a to b is equally likely.

parameters	a = lower endpoint, b = upper endpoint
p.f.	$f(x\|a, b) = \frac{1}{b-a+1}$
Mean	$\frac{a+b}{2}$
Variance	$\frac{(b-a)(b-a+2)}{12}$

Geometric(p)

X = the number of failures that occur before the first success in a sequence of independent and identically distributed Bernoulli trials.

parameters	p = probability of success on each trial
p.f.	$f(x\|p) = p(1-p)^x$
Mean	$\frac{1-p}{p}$
Variance	$\frac{1-p}{p^2}$

Negative Binomial(r, p)

X = the number of failures which occur in a sequence of independent and identically distributed Bernoulli trials before r successes occur.

parameters	r = target number of successes, p = probability of success on each trial
p.f.	$f(x\|r,p) = \binom{r+x-1}{x} p^r (1-p)^x$
Mean	$\frac{r(1-p)}{p}$
Variance	$\frac{r(1-p)}{p^2}$

Hypergeometric(A, B, n)

X = the number of successes in n draws (without replacement) from a finite population that contains exactly A successes and B failures.

parameters	A = number of successes in the population, B = number of failures in the population, n = sample size
p.f.	$f(x\|A,B,n) = \frac{\binom{A}{x}\binom{B}{n-x}}{\binom{A+B}{n}}$
Mean	$\frac{nA}{A+B}$
Variance	$\frac{nAB}{(A+B)^2} \frac{A+B-n}{A+B-1}$

Note that for *R* functions *dhyper*, *phyper*, *qhyper*, and *rhyper*, the arguments are $m = A$, $n = B$, and $k = n$.

Poisson(λ)

X = the number of events occurring in a fixed interval of time or space if these events occur with a known constant rate and independently of the time since the last event.

parameters	λ = rate parameter
p.f.	$f(x\|\lambda) = e^{-\lambda} \frac{\lambda^x}{x!}$
Mean	λ
Variance	λ