~~benoulli~~ binomial: sum of iid Bernoulli trials

parametric distribution	μ	σ^2	
uniform (a,b)	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	p.155
Bernoulli (p)	p	$p(1-p)$	p.150
binomial (n,p)	np	$np(1-p)$	p.151
normal (μ,σ)	μ	σ^2	p.152
exponential (λ)	$1/\lambda$	$1/\lambda^2$	p.156

$X \sim \text{Bernoulli}(p) \quad \mu = E[X] = \sum_{k} k\, P(X=k)$

$= \cancel{(1-p)\,0} + p \cdot 1 = p$

$E[g(X)] = \sum_{k} P(X=k)\, g(k)$

$\sigma^2 = Var[X] = E[(X-\mu)^2] = E[(X-p)^2] \quad g(X) = (X-p)^2$

$= \sum_{k} P(X=k)(k-p)^2 = (1-p)(0-p)^2 + p(1-p)^2$

$= (1-p)[p^2 + p(1-p)] = p(1-p)[\cancel{p} + 1 - \cancel{p}]$

$= p(1-p)$

amp m va ia e +2+3 2+

x + +2+2+3

P P x μ σ^2 2 + 2 2 3

p 7 r^{Σ} μ [ ] $\sum_k$ p X k

$\frac{1}{n} \sum f_k$ where f_k frequency of outcome k n X n

Ω

$\sum \frac{f_k}{n} k$ $P_{k,n}$ $\frac{f}{n}$ proportion of values sam if n

ti te population (true prob)

$\sum_k \hat{\ }_{k,n} k$

By the w of large numbers L N

$\lim_{n \to \infty}$ k

Binomial $X \sim$ Binomia $(n,)$

et Z Bernou $(p$ $+ X$ $\sum Z$

Linearity of expectation For <u>any</u> R Y_n $E[\sum\ ] \sum_i E[Y]$

μ $E[X]$ $E[\sum^n Z]$ $\sum_i E[Z]$ $n E[Z]$ np

<u>independent</u> Z n $Var[\sum Z]$ $\sum V$ $[Z]$

σ^2 V $[X]$ $\sum_i^n V$ $[Z]$ $n\,Var[Z]$ $np(\ p)$

p. 146	identically distributed	independent	
	no	no	
	no	yes	1 toss each of n coins (diff. p)
	yes	no	set $X_{1:n}$ all by same single coin toss
(iid)	yes	yes	n tosses of 1 coin

random variable: a random # drawn from an underlying population
statistic: a value derived from a random sample } p. 148
sampling distribution: distribution of a statistic

	probability pdf function		cumulative d function
discrete	distribution	$P(X=k)$	$P(X \le b) = \sum_{k \le b} P(X=k)$
continuous	density	$f(x) = P(X=k)$	$P(X \le b) = \int_{-\infty}^{b} f(x) = F(x)$

quantize / binning / bucketing

p. 145-146

$P(a \le X \le b) = P(X \le b) - P(X \le a)$

a —— b
(a, b]

$P(X \le b) = 1 - P(X > b)$