10/20/2016

$X \sim Geom(p) := (1-p)^{x-1} p$

$Supp(X) = \mathbb{N}$
$p \in (0,1)$

$X_1, X_2, \ldots \overset{iid}{\sim} Bern(p)$

Play poker until Royal Flush

$p() = \frac{4}{\binom{52}{5}} = 1.53/m = 0.0000153$

(a) Build a model

$X \sim Geom(0.0000153)$

(b) What's the probability you get R.F on a million th cop

$P(X = 1000000) = 1 - P = 0.99999859999 \cdot 0.00001$

(c) What's the Probability of getting flush on million th hand on 5 poker?

$P(X \leq 1000000) = F(1000000) = 1 - 0.999985^{1000000}$

$X = \min\{t : X_t = 1\}$ 0 0 0 0 0 1 0 0 0 1 0 1

$X = \min\{t : \sum_{i=1}^{t} X_i = r\}$ r

$P(X=0) = 0$ r=3

$P(X=1) = 0$

$P(X=2) = 0$ → 1 1 1

$P(X=3) = p^3$ $\binom{3}{2}(1-p)p^3$

$P(X=4) = \cancel{p^3 \binom{3}{1}(1-p)p^3}$

1 1 0 1
0 1 1 1
1 0 1 1
1 1 1 1

3

$P(X=5) = \cancel{p^3\, 6(1-p)^2 p^3}$ $\binom{4}{2}(1-p)^3 p^3$ 6

$P(X=x) = \binom{x-1}{2} p^3 (1-p)^{x-3}$

$X \sim NegBin(r,p) = \binom{x-1}{r-1}(1-p)^{x-r} p^r$

$Supp[X] = \{r, r+1, r+2, \ldots\}$

Paramater space : $p \in (0,1)$, $r \in \mathbb{N}$

$f(x) = x^2$

$f(q) = q^2$

$$X \sim NegBin(1, p) = \binom{x-1}{1-1}(1-p)^{x-1}p^1$$
$$= (1-p)^{x-1}p = Geom(p)$$

$$X_1, X_1, \dots X_r \overset{iid}{\approx} geom(p)$$

$$X_1 + X_2 + \dots + X_r \approx NegBin(r, p)$$

$$\boxed{1 = \sum_{x \in Supp(x)} p(x)}$$

$$\sum_{x=r}^{\infty} \binom{x-1}{r-1}(1-p)^{x-r}p^r$$

$$\sum_{i=0}^{\infty}(1-p)^{x-1} = p^{-1} \Rightarrow \sum_{i=1}^{\infty}(-1)(x-1)(1-p)^{x-2} = (-1)p^{-2}$$

$$\sum_{i=3}^{\infty}(-1)^2(x-1)(x-2)(1-p)^{x-3} = (-1)(-2)p^{-3}$$

$$(-1)\,d!\,p^{-d}$$

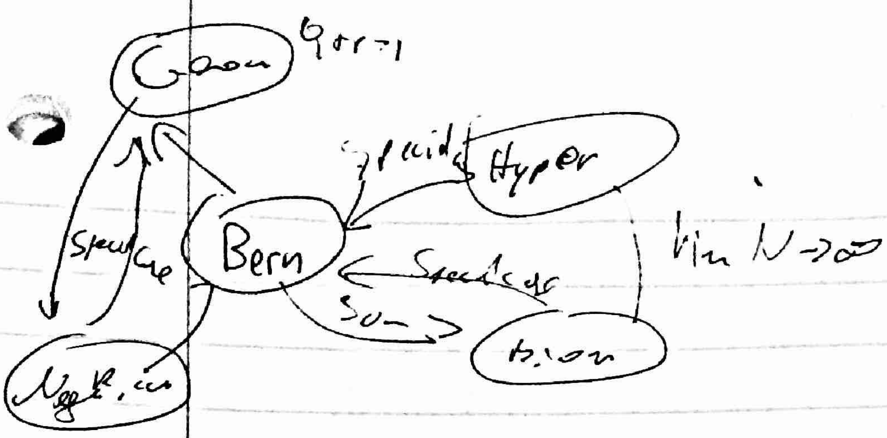
$$\cancel{= (r-1)!\,p^{-r}} \quad \sum_{x=r}^{\infty}(x-1)(x-2)\dots(x-(x+1))(1-p)^{x-r} = (r-1)!\,p^{-r}$$

$$p^r \cdot p^{-r} = 1$$

$$X \sim NegBin(r, p) = (1-p)^x p^r = \binom{x+r-1}{r-1}(1-p)^x p^r$$

$\shortparallel$
\# Failure

$$\frac{(x+r-1)!}{(r-1)!\,x!} = \frac{(x+r-1)(x+r-2)\dots r}{x!}$$



$x \sim \text{Bern}\left(\frac{1}{2}\right) := \begin{cases} 1 & \text{wp } 1/2 \\ 0 & \text{wp } 1/2 \end{cases}$

$x = 1 \in \text{Supp}[X]$

realization of w~

datum : Not true ~~Xes~~ yet

data : trop

$X \sim \text{Hyper}(\overset{n}{3}, \overset{K}{4}, \overset{N}{8})$

$X_1 \ldots X_7 \overset{iid}{\sim} (\overset{n}{3}, \overset{K}{4}, \overset{N}{8})$

$x_1 = 1$, X_1, X_2, X_3 $X \sim \text{Binomial}(8, \frac{1}{2})$