The Geometric Distribution

The geometric is a distribution of many Bernoulli, where we repeatedly take trials until we have one "success".

Ex: Flip coins until heads, how many flips or failures do you have

Ex: How many trials until you finally get the USB drive in

How many free throws to first basket
or how many misses before first basket

Defined by p, prob of success

What is X?

# trials	#failures	
1	0	Get success at 1st trial? p
2	1	success on 2nd trial? $(1-p)p$
3	2	success on 3rd trial? $(1-p)(1-p)p$
4	3	4th $(1-p)^3p$
5	4	5th $(1-p)^4p$

Do we count the success

Derive the PMF

Text uses this version $\mu = \frac{1}{p}$ $\sigma^2 = \frac{1-p}{p^2}$

PMF is $P(X=x) = \begin{cases} (1-p)^{x-1}p & x \in \{1,2,3,\dots\} \\ 0 & \text{otherwise} \end{cases}$

Counts # of trials including success

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R uses this version

$P(X=x) = \begin{cases} (1-p)^x p & x \in \{0,1,2,\dots\} \\ 0 & \text{otherwise} \end{cases}$

Counts # of failures before the first success

$\mu = \frac{1-p}{p} = \frac{1}{p} - 1$ $\sigma^2 = \frac{1-p}{p^2}$