MAT 105 - Probability & Statistics

A few special distributions

Name	Distribution	$E[X]$	$Var(X)$	Usage
Bernoulli(p)	$P(X=1)=p$, $P(X=0)=1-p$	p	$p(1-p)$	Returns 1 if the trial (such as a coin toss) is a success. Eg: X=1 if a fair coin lands H with $p=1/2$
Binomial(n,p)	$P(X=k)=\binom{n}{k}p^k(1-p)^{n-k}$	np	$np(1-p)$	Counts the number of successes in n Bernoulli trials. Eg: number of 6 in 20 die throws is $\mathrm{Bin}(20,1/6)$
Geometric(p)	$P(X=k)=p(1-p)^{k-1}$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	Counts number of Bernoulli trials until the first success. Eg: number of trials until a die lands on 5 first is Geom(1/6)
Neg Binomial(r,p)	$P(X=k)=\binom{k-1}{r-1}p^r(1-p)^{k-r}$	$\frac{r}{p}$	$\frac{r(1-p)}{p^2}$	Counts number of Bernoulli trials until r successes. Eg: number of trials until a coin lands on H 10 times is NBin(10,1/2)
Poisson(λ)	$P(X=k)=e^{-\lambda}\frac{\lambda^k}{k!}$	λ	λ	Counts number of rare events. Estimates Bin(n,p) with Pois(np). Eg: Finds number of misprints on a page, given the average λ.
Normal(μ,σ^2)	use z-score table	μ	σ^2	Describes rv's whose values cluster around the mean. Eg: Used to estimate sums of random variables, by normalizing and using CLT.