STAT 5700 formulas

$\binom{n}{r} =_n C_r = \frac{_nP_r}{r!} = \frac{n!}{(n-r)!r!}$

$P(B|A) = \frac{P(A \cap B)}{P(A)}$

$P(B'|A) = 1 - P(B|A)$

Bayes Rule: $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$

$\mu = E(Y) = \sum_{y \in \mathbb{S}} yp(y)$

$\sigma^2 = V(Y) = \sum_{y \in \mathbb{S}} (y-\mu)^2 p(y)$

Distribution	Probability Function	Mean	Variance
Binomial	$\binom{n}{y} p^y (1-p)^{n-y}$	np	$np(1-p)$
Geometric	$p(1-p)^{y-1}$	$\dfrac{1}{p}$	$\dfrac{1-p}{p^2}$
Hypergeometric	$\dfrac{\binom{r}{y}\binom{N-r}{n-y}}{\binom{N}{n}}$	$\dfrac{nr}{N}$	$n\left(\dfrac{r}{N}\right)\left(\dfrac{N-r}{N}\right)\left(\dfrac{N-n}{N-1}\right)$
Poisson	$\dfrac{\lambda^y e^{-\lambda}}{y!}$	λ	λ
Negative Binomial	$\binom{y-1}{r-1} p^r (1-p)^{y-r}$	$\dfrac{r}{p}$	$\dfrac{r(1-p)}{p^2}$

Geometric series: $\sum_{n=0}^{\infty} ar^n = \frac{a}{1-r}$

For geometric random variable, $P(Y > k) = (1-p)^k$

Maclaurin series expansion: $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$

Binomial expansion: $(a+b)^n = \sum_{y=0}^{n} \binom{n}{y} a^y b^{n-y}$