$Permutations\ Rule:$
$P^n_r = \frac{n!}{(n-r)!}$

$Combinations\ Rule:$
$C^n_r = \frac{n!}{r!(n-r)!}$

$Union: A \cup B$
$Intersection: A \cap B$

$Mutually\ Exclusive:$
$P(A \cup B) = P(A) + P(B)$

$Complement:$
$P(A) = 1 - P(\bar{A})$

$Joint\ Probability:$
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$Conditional\ Probability:$
$P(A|B) = \frac{P(A \cap B)}{P(B)} and P(B|A) = \frac{P(A \cap B)}{P(A)}$
$P(A \cap B) = P(A) * P(B|A) = P(B) * P(A|B)$

$For\ Independent:$
$P(A|B) = P(A) and P(B|A) = P(B)$
$P(A \cap B) = P(A) * P(B)$

$Law\ of\ Total Probability: P(A) = P(B_1 \cap A) + P(B_2 \cap A) + P(B_3 \cap A) =$
$P(B_1)P(A|B_1) + P(B_2)P(A|B_2) + ... + P(B_n)P(A|B_n)$

$Prior\ Probability$
$Posterior\ Probability$

$Bayes' Theorem: P(B_k|A) = \frac{P(B_k \cap A)}{P(A)} = \frac{P(B \cap A)}{P(B \cap A) + P(\bar{B} \cap A)}$

$Circle: (n-1)!$

Expected Value :

$$\mu = E(X) = \sum x * P(x)$$

The Variance of X is :

$$\sigma^2 = Var(X) = \sum (x - \mu)^2 * P(x)$$

Binomial Formula :

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

Under this case : $(X \ Bin(n, p))$

$$\mu = E(X) = np$$

$$\sigma^2 = Var(X) = np(1-p)$$

Poisson Probability Distribution Formula :

$$P(x) = P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

Under this Case :

$$\mu = E(X) = \lambda$$

$$\sigma^2 = Var(X) = \lambda$$

Hypergeometric Probability Distribution Formula :

$$P(x) = P(X = x) = \frac{\binom{r}{x}\binom{N-r}{n-x}}{\binom{N}{n}}$$

Under this Case :

$$\mu = E(X) = \frac{nr}{N}$$

$$\sigma^2 = Var(X) = n(\frac{r}{N})(\frac{N-r}{N})(\frac{N-n}{N-1})$$

Negative Binomial Distribution :

$$P(X = k) = \binom{k-1}{r-1} p^r (1-p)^{k-r}$$

Under this case : $(X \ NegBin(r, p))$

$$\mu = E(X) = \frac{r}{p}$$

$$\sigma^2 = Var(X) = \frac{r(1-p)}{p^2}$$

Geometric Distribution : $N \sim Geo(x)$

$$P(N = x) = p(1-p)^{x-1}$$

Sampling Distribution$(\bar{x})$

$$\bar{x} \sim N(\mu, (\frac{\sigma}{\sqrt{n}})^2)$$

$$(if \frac{n}{N} > 0.05) \ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \times \sqrt{\frac{N-n}{N-1}}$$

Normal Distribution ==> Binomial Distribution

$(if np > 5 \ \& \ n(1-p) > 5)$

$$\mu = np\sigma = \sqrt{np(1-p)}$$

1. $\bar{x} \pm z_{\frac{\alpha}{2}} \times \frac{\sigma}{\sqrt{n}}$

2. $v = n - 1$

3. $(Remind : like\ within...)$

$z_{\frac{\alpha}{2}} \times \frac{\sigma}{\sqrt{n}}$

4. $\bar{x} \pm t_{\frac{\alpha}{2};v} \times \frac{s}{\sqrt{n}}$

5. $s^2 = \frac{\sum x^2 - (\sum x)^2/n}{n-1}$

6. $(\bar{x1} - \bar{x2}) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{{\sigma_1}^2}{n1} + \frac{{\sigma_2}^2}{n2}}$