STATS FORMULAS

Variance: $s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})^2$

STD: $s = \sqrt{s^2}$

Permutation: $P_r^n = \frac{n!}{(n-r)!}$

Combination: $C_r^n = \frac{n!}{r!(n-r)!}$

Probability of Intersection of Two Events: $P(A \cap B) = P(A)P(B|A), P(B)P(A|B)$

Chance of A and B occurring relative to S: $P(A|B) = \frac{P(A \cap B)}{P(B)}$

If A and B are independent:

$$P(A|B) = P(A)$$

$$P(B|A) = P(B)$$

$$P(A \cap B) = P(A)P(B)$$

Dependent: $P(A) * P(B|A)$

General Addition Rule: A or B occurring relative to S

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

A and B are mutually exclusive, P(A∩B)=0: $P(A \cup B) = P(A) + P(B)$

Total Probability: $P(A) = \sum_{i=1}^{n} P(A|Bi)P(Bi)$

Bayes' Theorem with P(A)>0 and P(B)>0: $P(B|A) = \frac{P(A|B)P(B)}{P(A)}$

If 0<P(B)<1: P(B|A)= $\frac{P(A|B)P(B)}{P(A|B)P(B)+P(A|B')P(B')}$

Probability Mass Function: $p(y) = P(Y = y)$

Expected: $E(Y) = 1/p$

Variance: $\frac{1-p}{p^2}$

Binomial Distribution: $p(y) = \binom{n}{y} p^y q^{n-y}$

Geometric Distribution: $p(y) = P(Y = y) = q^{y-1}p$

Success occurs on or before nth trial: $P(X \leq n) = 1 - (1-p)^n$

Success occurs before the nth trial: $P(X < n) = 1 - (1-p)^{n-1}$

Success occurs on or after nth trial: $P(X \geq n) = (1-p)^{n-1}$

Success occurs after the nth trial: $P(X > n) = (1-p)^n$

Hypergeometric Probability Distribution: $p(y) = \frac{\binom{r}{y}\binom{N-r}{n-y}}{\binom{N}{n}}$

Poisson Probability Distribution: p(y) = $\frac{\lambda^y}{y!}e^{-\lambda}$

Expected value of continuous random variable Y: $E(Y) = \int_{-\infty}^{\infty} yf(y)dy$

Variance of continuous random variable = E(Y^2) – E(Y)^2

Uniform Probability Distribution: $f(y) = \begin{cases} \frac{1}{\theta 2 - \theta 1}, & \theta 1 \le y \le \theta 2, \\ 0, & elsewhere. \end{cases}$

Normal Probability Distribution: $f(y) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(y-\mu)^2}{2\sigma^2}}$, $-\infty < y < \infty$

Gamma Probability Distribution: $f(y) = \begin{cases} \frac{y^{\alpha-1}e^{-\frac{y}{\beta}}}{\beta^\alpha \Gamma(\alpha)} \\ 0, & elsewhere \end{cases}$

Exponential distribution with parameter $\beta > 0$: $\begin{cases} \frac{1}{\beta}e^{-\frac{y}{\beta}} \\ 0, & elsewhere \end{cases}$ $, 0 \le y < \infty,$

Beta Probability Distribution: $f(y) = \begin{cases} \frac{y^{a-1}(1-y)^{\beta-1}}{B(\alpha,\beta)}, & 0 \le y \le 1, \\ 0, & elsewhere \end{cases}$

Testing if Y_1 and Y_2 are jointly continuous random variables:

$$\int_{y2}^{y1} f(t_1, t_2)dt_2\, dt_1$$

Conditional discrete probability function: $p(y_1|y_2) = \frac{p(y_1,y_2)}{p_2(y_2)}$

Showing that Y_1 and Y_2 are independent given a density function f(y1,y2):

$$f_1(y_1) = \int_{-\infty}^{\infty} f(y_1\,, y_2)dy_2$$

$$f_1(y_2) = \int_{-\infty}^{\infty} f(y_1\,, y_2)dy_1$$

$f(y_1, y_2) = f_1(y_1)f_2(y_2)$