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Formula Sheet

$$Standard\ Deviation\ = \sqrt{\frac{\sum(x_i - \mu)^2}{N}}$$

$$Combonation \binom{n}{r} = \frac{n!}{r!\,(n-r)!}$$

$$Permutation \binom{n}{r} = \frac{n!}{(n-r)!}$$

$$Multinomial\ Coefficient \binom{n}{r} = \frac{n!}{n_1!\,n_2!\,\dots\,n_k!}$$

$$Baye's\ Theorem = \frac{P(A|B)P(B)}{P(B)} = \frac{P(A|B)P(B)}{P(A|B)P(B) - P(A|B')P(B')}$$

$$Binomial\ Distribution = \binom{r}{y} p^y q^{n-y}$$

$$E(Y) = np$$

$$V(Y) = npq$$

$$Geometric\ Distribution = q^{y-1}p$$

$$E(Y) = \frac{1}{p}$$

$$V(Y) = \frac{1-p}{p^2}$$

$$Negative\ Binomial\ Distribution = \binom{y-1}{r-1} p^r q^{y-r}$$

$$E(Y) = \frac{r(1-p)}{p}$$

$$V(Y) = \frac{r(1-p)}{p^2}$$

$$Hypergeometric\ Distribution = \frac{\binom{r}{y}\binom{N-r}{n-y}}{\binom{N}{n}}$$

$$E(Y) = n\frac{K}{N}$$

$$V(Y) = n\frac{K}{N}\frac{N-K}{N}\frac{N-n}{N-1}$$

$$Poisson\ Distribution = \frac{\lambda^y}{y!}e^{-\lambda}$$

$$E(Y) = \lambda$$

$$V(Y) = \lambda$$

$$Tchebysheff's\ Theorem = P(|Y-\mu| < k\sigma) \geq 1 - \frac{1}{k^2}$$

$$Uniform\ Distribution\ (pdf) = \begin{cases} \frac{1}{b-a}, & a \leq y \leq b \\ 0, & elsewhere \end{cases}$$

$$E(Y) = \frac{a+b}{2}$$

$$V(Y) = \frac{(b-a)^2}{12}$$

$$Gamma\ Distribution\ (pdf) = \begin{cases} \frac{y^{\alpha-1}e^{\frac{-y}{\beta}}}{\beta^{\alpha}F(\alpha)}, & 0 \leq y \leq \infty \\ 0, & elsewhere \end{cases}$$

$$E(Y) = \alpha\beta$$

$$V(Y) = \alpha\beta^2$$

Continuous Random Variables

$$D_y[F(y)] = f(y) \leftrightarrow \int_{-\infty}^{\infty} f(y)dy = F(y)$$

$$P(a \leq Y \leq b) = \int_a^b f(y)dy$$

$$E(Y) = \int_{-\infty}^{\infty} y \cdot f(y)dy$$

$$E(g(Y)) = \int_{-\infty}^{\infty} g(y) \cdot f(y) dy$$

$$E(c \cdot g(Y)) = c \cdot E(g(Y))$$

$$Joint\ Probability = F(x,y) = \int_{-\infty}^{x} \int_{-\infty}^{y} f(x,y) dy dx$$

$$Marginal\ Probability = f_1(x) = \int_{-\infty}^{\infty} f(x,y) dy$$

$$Marginal\ Probability = f_2(y) = \int_{-\infty}^{\infty} f(x,y) dx$$