STATISTICS FORMULAS

$$R = H - L$$

$$ML = \frac{n+1}{2}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$s^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1} = \frac{\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}}{n-1}$$

$$s = \sqrt{s^2} = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}}{n-1}}$$

$$z = \frac{x-\mu}{\sigma} \qquad x = \sigma z + \mu$$

$$z = \frac{x-\bar{x}}{s} \qquad x = sz + \bar{x}$$

Probability

$$P(A) + P(A^c) = 1$$

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

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

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \quad \text{where } P(B) \neq 0$$

General Discrete Distribution

$$\mu = E(x) = \sum_{\text{all } x} x\,p(x)$$

$$\sigma^2 = \sum_{\text{all } x} [(x-\mu)^2]\,p(x) = \left[\sum_{\text{all } x} x^2\,p(x)\right] - \mu^2$$

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

Binomial Distribution

$$p(x) = \binom{n}{x} p^x q^{n-x}, \quad x = 0, 1, \ldots, n$$

$$\mu = np \qquad \sigma^2 = npq$$

Parameters of the Sampling Distributions of $\bar{x}$ and $\hat{p}$

Statistic (Estimator)	*Mean of Estimator*	*Standard Deviation of Etimator*	*z-score of Estimator*
$\bar{x}$	μ	$\frac{\sigma}{\sqrt{n}}$	$\frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$
$\hat{p} = \frac{x}{n}$	p	$\sqrt{\frac{pq}{n}}$	$\frac{\hat{p}-p}{\sqrt{\frac{pq}{n}}}$

Inference: Large Samples

Parameter	*Test Statistic*	*Confidence Interval*
μ	$z = \dfrac{\bar{x} - \mu_o}{\frac{\sigma}{\sqrt{n}}}$	$\bar{x} \pm z_{\frac{\alpha}{2}} \cdot \dfrac{\sigma}{\sqrt{n}}$
p	$z = \dfrac{\hat{p} - p_o}{\sqrt{\frac{p_o q_o}{n}}}$	$\hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\dfrac{\hat{p}\hat{q}}{n}}$

Inference: Small Samples

Parameter	*Test Statistic*	*df*	*Confidence Interval*
μ	$t = \dfrac{\bar{x} - \mu_o}{\frac{s}{\sqrt{n}}}$	$n-1$	$\bar{x} \pm t_{\frac{\alpha}{2}} \dfrac{s}{\sqrt{n}}$

Inference: Population Variance

Parameter	*Test Statistic*	*df*	*Confidence Interval*
σ^2	$\chi^2 = \dfrac{(n-1)\,s^2}{\sigma^2_o}$	$n-1$	$\dfrac{(n-1)\,s^2}{\chi^2_{\alpha/2}} < \sigma^2 < \dfrac{(n-1)\,s^2}{\chi^2_{1-\alpha/2}}$