Formula Sheet Math 222

General form of a confidence interval estimate $\pm$ margin of error, where

$$\text{margin of error} = (\text{critical value}) \times SE_{\text{estimate}}$$

General form of a test statistic

$$\frac{\text{statistic} - \text{hypothesized valued}}{SE_{\text{statistic}}}$$

Standard errors*

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}} \qquad SE_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$SE_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \qquad SE_{\hat{p}_1 - \hat{p}_2} = \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

> $*$ *When testing a null hypothesis about proportions, it is better to use the hypothesized population proportion p_0 rather than $\hat{p}$ in the formula for standard error for one-sample tests, and it is better to used the pooled proportion $\hat{p}$ rather than either individual sample proportion $\hat{p}_1$ or $\hat{p}_2$ in the formula for standard error in two-sample tests.*

Probability Rules

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A)P(B|A)$$

Expected Value & Variance For a discrete random variable X with outcomes x_k and corresponding probabilities p_k.

$$E(X) = \mu = \sum p_k x_k$$

$$\text{Var}(X) = \sigma^2 = \sum p_k (x_k - \mu)^2$$

Expected Value Rules

$$E(cX) = cE(X)$$

$$E(X+Y) = E(X) + E(Y)$$

Variance Rules

$$\text{Var}(cX) = c^2\,\text{Var}(X)$$

$$\text{Var}(X+Y) = \text{Var}(X) + \text{Var}(Y) \qquad (\text{only if } X \text{ and } Y \text{ are independent})$$

Mean & Variance for the Binomial Distribution If $X \sim \text{Binom}(n, p)$, then

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

$$\text{Var}(X) = \sigma^2 = p(1-p)n$$