We are always trying to make inference about a population parameter from a sample statistic. We have three methods for inference:

1. Simulation/randomization methods
2. Exact/probability methods
3. Distributional approximations

We have focused (perhaps too much) on the distributional approximation methods. However, all of the problems we have studied could be solved with any of the three methods.

| Parameter | Statistic | Hypothesis test | Confidence inteval | Conditions |
|---|---|---|---|---|
| $p$ | $\hat{p}$ | $H_0 : p = p_0$, $z = \frac{\hat{p}-p_0}{SE}$, $SE = \sqrt{\frac{p_0(1-p_0)}{n}}$ | $\hat{p} \pm z^* SE$, $SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ | **I**, $np > 10$, $n(1-p) > 10$ |
| $p_1 - p_2$ | $\hat{p_1} - \hat{p_2}$ | $H_0 : p_1 - p_2 = 0$, $z = \frac{\hat{p_1}-\hat{p_2}}{SE}$, $SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n_1} + \frac{\hat{p}(1-\hat{p})}{n_2}}$ | $\hat{p_1} - \hat{p_2} \pm z^* SE$, $SE = \sqrt{\frac{\hat{p_1}(1-\hat{p_1})}{n_1} + \frac{\hat{p_2}(1-\hat{p_2})}{n_2}}$ | **I**, **N** |
| $X^2$ | $X^2$ | $H_0$ : the counts are the same, $X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$ | | **I**, 5 successes, $df > 2$ |
| $\mu$ | $\bar{x}$ | $H_0 : \mu = \mu_0$, $t = \frac{\bar{x}-\mu_0}{SE}$, $SE = \frac{s}{\sqrt{n}}$ | $\bar{x} \pm t^* SE$, $SE = \frac{s}{\sqrt{n}}$ | **I**, **N** |
| $\mu_1 - \mu_2$ | $\bar{x_1} - \bar{x_2}$ | $H_0 : \mu_1 - \mu_2 = \mu_0$, $t = \frac{\bar{x_1}-\bar{x_2}-\mu_0}{SE}$, $SE = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ | $\bar{x_1} - \bar{x_2} \pm t^* SE$, $SE = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ | **I** (between and within),**N** |
| $\mu_1, \mu_2, \ldots, \mu_n$ | $\bar{x}_1, \bar{x}_2, \ldots \bar{x}_n$ | $H_0 : \mu_1 = \mu_2 = \cdots = \mu_n$, $F = \frac{MSG}{MSE}$ | | **I**, **N**, **E** |
| $\beta_1$ | $\hat{\beta}_1$ | $H_0 : \beta_1 = 0$, $t = \frac{\hat{\beta}_1 - 0}{SE}$ | $\hat{\beta}_1 \pm t * SE$ | **L**, **I**, **N**, **E** |