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	$\hat{p}$	$H_0 : p = p_0$, $z = \frac{\hat{p}-p_0}{SE}$, $SE = \sqrt{\frac{p_0(1-p_0)}{n}}$ $H_A : p \neq p_0$	$\hat{p} \pm z^* SE$, $SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	**I**, $np > 10$, $n(1-p) > 10$
$p_1 - p_2$	$\hat{p_1} - \hat{p_2}$	$H_0 : p_1 - p_2 = p_0$, $z = \frac{\hat{p_1}-\hat{p_2}-p_0}{SE}$, $SE = \sqrt{\frac{\hat{p_1}(1-\hat{p_1})}{n_1} + \frac{\hat{p_2}(1-\hat{p_2})}{n_2}}$ $H_A : p_1 - p_2 \neq p_0$	$\hat{p_1} - \hat{p_2} \pm z^* SE$, $SE = \sqrt{\frac{\hat{p_1}(1-\hat{p_1})}{n_1} + \frac{\hat{p_2}(1-\hat{p_2})}{n_2}}$	**I**, **N**
$p_1 - p_2$	$\hat{p_1} - \hat{p_2}$	$H_0 : p_1 - p_2 = 0$, $z = \frac{\hat{p_1}-\hat{p_2}}{SE}$, $SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n_1} + \frac{\hat{p}(1-\hat{p})}{n_2}}$ $H_A : p_1 - p_2 \neq 0$		**I**, **N**
X^2	$\hat{X}^2$	H_0 : the counts are the same, $X^2 = \sum \frac{(O_i-E_i)^2}{E_i}$ H_A : the counts are different		**I**, 5 successes, $df \geq 2$
μ	$\bar{x}$	$H_0 : \mu = \mu_0$, $t = \frac{\bar{x}-\mu_0}{SE}$, $SE = \frac{s}{\sqrt{n}}$ $H_A : \mu \neq \mu_0$	$\bar{x} \pm t^* SE$, $SE = \frac{s}{\sqrt{n}}$	**I**, **N**
μ_{diff}	$\bar{x}_{diff}$	$H_0 : \mu_{diff} = \mu_0$, $t = \frac{\bar{x}_{diff}-\mu_0}{SE_{diff}}$, $SE_{diff} = \frac{s_{diff}}{\sqrt{n}}$ $H_A : \mu_{diff} \neq \mu_0$	$\bar{x} \pm t^* SE$, $SE = \frac{s_{diff}}{\sqrt{n}}$	**I**, **N**
$\mu_1 - \mu_2$	$\bar{x_1} - \bar{x_2}$	$H_0 : \mu_1 - \mu_2 = \mu_0$, $t = \frac{\bar{x_1}-\bar{x_2}-\mu_0}{SE}$, $SE = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ $H_A : \mu_1 - \mu_2 \neq \mu_0$	$\bar{x_1} - \bar{x_2} \pm t^* SE$, $SE = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	**I**,**N**
$\mu_1, \mu_2, \ldots, \mu_n$	$\bar{x}_1, \bar{x}_2, \ldots \bar{x}_n$	$H_0 : \mu_1 = \mu_2 = \cdots = \mu_n$, $F = \frac{MSG}{MSE}$ H_A : at least one of the μ_i is different		**I** (between and within), **N**, **E**
β_i	$\hat{\beta}_1$	$H_0 : \beta_1 = 0$, $t = \frac{\hat{\beta}_1-0}{SE}$ $H_A : \beta_i \neq 0$	$\hat{\beta}_1 \pm t * SE$	**L**, **I**, **N**, **E**

Where

- **L**inearity
- **I**ndependence
- **N**ormality
- **E**quality of variance