# Inference Formulas & Conditions

| Situation | Confidence Interval | Significance Test | Conditions |
|---|---|---|---|
| **1 mean** **( $\sigma$ known)** | $\bar{x} \pm z^* \frac{\sigma}{\sqrt{n}}$ <br> **TI-84 ZInterval** | $H_o: \mu = \mu_o$ <br> $Z = \frac{\bar{x} - \mu_o}{\frac{\sigma}{\sqrt{n}}}$ <br> **TI-84 Z-Test** | 1. SRS or random sample <br> 2. n is 10% less than population <br> 3. population is normal **or** large sample size (Central Limit Theorem: $n \geq 30$) |
| **1 mean** **( $\sigma$ not known)** <br> **or** <br> **2 means** **(matched pairs)** | $\bar{x} \pm t^*_{n-1} \frac{s}{\sqrt{n}}$ <br> **TI-84 TInterval** | $H_o: \mu = \mu_o$ <br> or <br> $H_o: \mu_{Diff} = 0$ <br> **for paired test** <br> $t = \frac{\bar{x} - \mu_o}{\frac{s}{\sqrt{n}}}$ <br> Degrees of freedom = n - 1 <br> **TI-84 T-Test** | 1. SRS, random sample, or random assignment <br> 2. n is 10% less than population (Independent) <br> 3. population is normal **or** large sample size ($n \geq 30$) **or** moderate sample size with moderate skewness or outliers **GRAPH DATA!! (NPP)** <br> 4. **For matched pairs state why they are matched.** |
| **2 means** **(independent)** | $(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ <br> **TI-84+ 2-SampTInt** | $H_o: \mu_1 = \mu_2$ <br> $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ <br> Degrees of freedom = n – 1 (n = smaller sample) or use calculator <br> **TI-84+ 2-SampTTest** | 1. SRS, random sample, or random assignment for **both** samples <br> 2. n is 10% less than population for both <br> 4. population is normal **or** large sample size **or** moderate sample size with moderate skewness or outliers. **GRAPH DATA!! (NPP)** <br> 3. independently chosen samples |

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| **1 proportion**<br><br>**(q = 1 – p)** | $\hat{p} \pm z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}$<br><br>**TI-84+ 1-PropZInt** | $H_o$: $p = p_0$<br><br>$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$<br><br>**TI-84+ 1-PropZTest** | 1. SRS or random sample<br>2. n is less than 10% of population<br>3. **CI**: $n\hat{p} \geq 10$ & $n\hat{q} \geq 10$<br>4. **ST**: $np_0 \geq 10$ & $nq_0 \geq 10$ |
| **2 proportions**<br><br>**(q = 1 – p)** | $(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$<br><br>**TI-84+ 2-PropZInt** | $H_o$: $p_1 = p_2$<br><br>$z = \frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\hat{p}_c\hat{q}_c\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$<br><br>**TI-84+ 2-PropZTest** | 1. SRS or random sample<br>2. population size ≥ 10n<br>3. independently chosen samples<br>4. **CI**: $n_1\hat{p}_1 \geq 5$ & $n_1\hat{q}_1 \geq 5$ & $n_2\hat{p}_2 \geq 5$ & $n_2\hat{q}_2 \geq 5$<br>**ST**: $n_1\hat{p} \geq 5$ & $n_1\hat{q} \geq 5$ & $n_2\hat{p} \geq 5$ & $n_2\hat{q} \geq 5$<br>5. $\hat{p}_c = \frac{x_1 + x_2}{n_1 + n_2}$ **pooled for Hypothesis Test** |
| **More than 2 Proportions**<br><br>**Two-Way Table** | **Independence**<br>(1 population, 2 variables)<br><br>**Homogeneity**<br>(2 or more populations, 2 variables) | $H_o$: All of the proportions are the same.<br><br>$X^2 = \sum \frac{(O-E)^2}{E}$<br><br>df = (r–1)(c–1)<br>r = rows, c = columns<br><br>**TI-84+ $\chi^2$-Test** | 1. SRS or random sample<br>2. independently chosen samples<br>3. all expected counts are ≥ 5 and no more than 20% of expected counts are less than 5. |

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|---|---|---|---|
| **More than 2 Proportions**<br><br>**One-Way Table**<br><br>**Goodness of Fit** | 1 population; 1 population | $H_o$: All of the proportions are the same.<br><br>$X^2 = \sum \frac{(O-E)^2}{E}$<br><br>df = n – 1 | 1. SRS or random sample<br>2. independently chosen samples<br>3. all expected counts are ≥ 5 and no more than 20% of expected counts are less than 5. |
| **Regression Slope**<br><br>$\mu_y = \alpha + \beta_x$<br>**Check computer printout for a, b, S, SE$_b$, t$_{statistic}$, & p-value** | $b \pm t^* SE_b$<br><br>$SE_b = \frac{\sqrt{\frac{1}{n-2}\sum(y-\hat{y})^2}}{\sqrt{\sum(x-\bar{x})^2}}$ | $H_o$: ß = 0<br>**or**<br>$H_o$ :There is no relationship between the two variables<br><br>$t = \frac{b}{SE_b}$<br>Degrees of freedom = n - 2<br><br>**TI-84+ LinRegTTest** | **L**: Examine Scatterplot: roughly linear<br>**I**: Independent observations (10% rule if sampling is done without replacement)<br>**N**: Normal graph of residuals (stemplot, histogram, or NPP)<br>**E**: Equal Variance of the residuals<br>**R**: Random sampling or randomized assignment |

**Work to show: parameter of interest, hypotheses, verification of assumptions, name of procedure, picture, z/t/chi calculation with substituted values and results, p-value, decision, and conclusion in context.**