Notation: **hv** is the hypothesized value, **σ** is the population standard deviation, **s** is the sample standard deviation, **n** is the sample size, **df** is degrees of freedom

| **Procedure type** | **Conditions for Inference** | **Confidence interval** | **Hypotheses** | **Test Statistic/Table/P-value** |
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| Ch 16/17/18<br><br>**z test** | Data are SRS<br>Population has N(μ,σ)<br>μ is unknown parameter<br>**σ is known** | Confidence interval for μ is<br>$\bar{x} \pm z^* \frac{\sigma}{\sqrt{n}}$<br>find $z^*$ at the bottom of table C<br><br>Margin of error is m = $z^* \frac{\sigma}{\sqrt{n}}$<br>The sample size is $n = \left(\frac{z^*\sigma}{m}\right)^2$ | 1) $H_0: \mu = \mu_0$<br>$H_A: \mu > \mu_0$<br>(one-sided alternative)<br><br>2) $H_0: \mu = \mu_0$<br>$H_A: \mu < \mu_0$<br>(one-sided alternative)<br><br>3) $H_0: \mu = \mu_0$<br>$H_A: \mu \neq \mu_0$<br>(two-sided alternative) | **One–sample *z* test statistic**<br>$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$<br>P – value is<br>1) $P(Z \geq z)$<br>2) $P(Z \leq z)$<br>3) $2P(Z \geq \lvert z \rvert)$<br>Use table A to find p-value:<br>$P(Z \leq z)$ just value from the table body for appropriate z<br>$P(Z \geq z)$ = 1 - $P(Z \leq z)$<br>$2P(Z \geq \lvert z \rvert) = 2(1 - P(Z \leq z))$ |
| Ch 20<br><br>**One-sample t test**<br><br>**Matched pairs t test** | Data are SRS<br>Population has N(μ,σ)<br>μ is unknown parameter<br>**σ is unknown**<br><br>**Use s (sample standard deviation)**<br>$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}$<br>Check conditions (**use safely t** procedure if):<br>• $n < 15$: approx. Normal distribution (single peaked, roughly symmetric, no outliers, no skewness)<br>• $n \geq 15$: no outliers, no strong skewness<br>• $n \geq 40$: can use t procedure even for clearly skewed distribution | **One-sample t confidence interval** for μ is<br>$\bar{x} \pm t^* \frac{s}{\sqrt{n}}$<br><br>find $t^*$ in the body of table C by knowing df = n – 1 and level of confidence (95%, 90%, etc)<br><br>$\frac{s}{\sqrt{n}}$ is the standard error | 4) $H_0: \mu = \mu_0$<br>$H_A: \mu > \mu_0$<br>(one-sided alternative)<br><br>5) $H_0: \mu = \mu_0$<br>$H_A: \mu < \mu_0$<br>(one-sided alternative)<br><br>6) $H_0: \mu = \mu_0$<br>$H_A: \mu \neq \mu_0$<br>(two-sided alternative) | **One-sample t test**<br>$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$<br>with df = n – 1<br>P – value is<br>1) $P(T \geq t)$<br>2) $P(T \leq t)$<br>3) $2P(T \geq \lvert t \rvert)$<br>Use table C to find p-value<br>(last two rows in the table for appropriate t)<br><br>**Matched pairs t procedures**<br>to compare the responses to the two treatments in a **matched pairs design**<br>1) find the difference between the responses within each pair.<br>2) apply the one–sample t test to these differences.<br>The parameter μ in a matched pairs t procedure is the mean difference in the responses to the two treatments within matched pairs of subjects in the entire population. |

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| Ch 21<br><br>**Two-Sample Problems** | Two samples are SRSs<br>Samples are independent<br>Each population has Normal distr.<br>$\boldsymbol{\mu_1, \mu_2, \sigma_1, \sigma_2}$ **are unknown**<br>but we **know** (or can calculate)<br>$\boldsymbol{s_1, s_2}$<br>$s_1$ *and* $s_2$ are the sample standard deviations<br>Check conditions (**use safely t** procedure if):<br>• $n_1 + n_2 < 15$: approx. Normal distribution (single peaked, roughly symmetric, no outliers, no skewness)<br>• $n_1 + n_2 \geq 15$: no extreme outliers, no strong skewness<br>• $n_1 + n_2 \geq 40$: can use t procedure even for clearly skewed distribution | Conf. interval for $\mu_1 - \mu_2$ is<br>$(\overline{x_1} - \overline{x_2}) \pm t^* \sqrt{\frac{s_1}{n_1} + \frac{s_2}{n_2}}$<br>find $t^*$ in the body of table C by knowing df and level of confidence (95%, 90%, etc)<br><br>df is the smaller of $n_1 - 1$ and $n_2 - 1$<br><br>Standard error of the statistic $(\overline{x_1} - \overline{x_2})$ is $\sqrt{\frac{s_1}{n_1} + \frac{s_2}{n_2}}$<br><br>Use positive difference $\overline{x_1} - \overline{x_2}$ (it easier to work) | 1) $H_0: \mu_1 - \mu_2 = hv$<br>$H_A: \mu_1 - \mu_2 > hv$<br>(one-sided alternative)<br><br>2) $H_0: \mu_1 - \mu_2 = hv$<br>$H_A: \mu_1 - \mu_2 < hv$<br>(one-sided alternative)<br><br>3) $H_0: \mu_1 - \mu_2 = hv$<br>$H_A: \mu_1 - \mu_2 \neq hv$<br>(two-sided alternative) | **Two–sample *t* statistic**<br>$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1}{n_1} + \frac{s_2}{n_2}}}$<br>df is the smaller of $n_1 - 1$ and $n_2 - 1$<br><br>P – value is<br>1) $P(T \geq t)$<br>2) $P(T \leq t)$<br>3) $2P(T \geq \|t\|)$<br>Use table C to find p-value (last two rows in the table for appropriate t) |
| Ch 22<br><br>**Sample proportion** | Tests and confidence intervals for a population proportion *p* when the data are an SRS of size n are based on the **sample proportion** $\boldsymbol{\hat{p}}$<br><br>$\hat{p} = \frac{\#of\ successes\ in\ the\ sample}{n}$<br>- n is large<br>- $\hat{p}$ has approximately the Normal distribution with mean p and standard deviation $\sqrt{\frac{p(1-p)}{n}}$<br><br>**Use this test** in practice when $np_0 \geq 10$ and $n(1 - p_0) \geq 10$ | CI for population proportion p is<br>$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$<br><br>find $z^*$ at the bottom of table C for approp. level of confidence<br>Use this interval only when the counts of successes and failures are both 15 or greater<br><br>Margin of error is $m = z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$<br><br>Find the **sample size** as<br>$n = \left(\frac{z^*}{m}\right)^2 p^*(1 - p^*)$<br>$p^*$ is a guessed value for the sample proportion, use $p^* = 0.5$ | 1) $H_0: p = p_0$<br>$H_A: p > p_0$<br>(one-sided alternative)<br><br>2) $H_0: p = p_0$<br>$H_A: p < p_0$<br>(one-sided alternative)<br><br>3) $H_0: p = p_0$<br>$H_A: p \neq p_0$<br>(two-sided alternative) | **z statistic**<br>$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1 - p_0)}{n}}}$<br>P – value is<br>1) $P(Z \geq z)$<br>2) $P(Z \leq z)$<br>3) $2P(Z \geq \|z\|)$<br><br>Use table A to find p-value:<br>$P(Z \leq z)$ just value from the table body for appropriate z<br>$P(Z \geq z) = 1 - P(Z \leq z)$<br>$2P(Z \geq \|z\|) = 2(1 - P(Z \leq z))$ |

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| Ch 25<br><br>**Chi-square test** | **Two–way table:** Count table used to organize data about two categorical variables. Values of the row variable label the rows that run across the table, and values of the column variable label the columns that run down the table.<br><br>**Safely use** the chi-square test when all expected cell counts are at least 1 and no more than 20% are less than 5. | The **expected count** in any cell of a two–way table when $H_0$ is true is<br><br>$expected\ count = \frac{row\ total \times column\ total}{table\ total}$<br><br>**Observed counts** come from the data | $H_0$: there is ***no relationship*** between two categorical variables<br><br>$H_A$: there is **some *relationship*** between two categorical variables | For a two–way table with ***r* rows and c columns** the **chi–square statistic** is<br><br>$\chi^2 = \sum \frac{(observed\ count - expected\ count)^2}{expected\ count}$<br><br>where the sum is overall possible values of the categorical variable<br><br>with $df = (r - 1)(c - 1)$ |