Section 11.3: Inference about Two Means: Independent Samples

Performing a Hypothesis Test Regarding the Difference Between Two Independent Means

Step 1: State the null and alternative hypotheses.

<div align="center">

Two-Tailed   Left-Tailed   Right-Tailed

$H_0: \mu_1-\mu_2 = 0$ $H_0: \mu_1-\mu_2 = 0$ $H_0: \mu_1-\mu_2 = 0$

$H_1: \mu_1-\mu_2 \neq 0$ $H_1: \mu_1-\mu_2 < 0$ $H_1: \mu_1-\mu_2 > 0$

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Step 2: Decide on a level of significance, α.

Step 3: Compute the test statistic, $t_0 = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$.

Step 4: Determine the P-value.

Step 5: Reject the null hypothesis if the P-value is less than the level of significance, α.

Step 6: State the conclusion.

Hypothesis Testing Regarding $\mu_1-\mu_2$ Using StatCrunch

1. Enter the data. (Note: If you're copying from another file, be careful - put the column with the most entries first. StatCrunch does not handle spaces well.)
2. Go to **Stat** > **t-Statistics** > **Two Sample**, then **with data** or **with summary**.
3. If you chose *with data*, select the columns containing the 1st and 2nd samples. Otherwise, enter all the sample statistics.
4. Uncheck "Pool variances" and press **Next**.
5. Set the null mean difference and the alternative hypothesis.
6. Click on **Calculate**.

Confidence Intervals about the Difference Between Two Means

Since the distribution of $\bar{x}_1 - \bar{x}_2$ follows the t-distribution, we can also create a confidence interval for the difference between two population means.

In general, a **$(1-\alpha)100\%$ confidence interval for $\mu_1-\mu_2$** is

$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \cdot \sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$$

where $t_{\alpha/2}$ is computed with min$\{n_1-1, n_2-1\}$ degrees of freedom.

Note: The sample sizes must be large ($n_1, n_2 \geq 30$) with no outliers or the populations must be normally distributed.

Confidence Intervals About $\mu_1-\mu_2$ Using StatCrunch

1. Enter the data. (Note: If you're copying from another file, be careful - put the column with the most entries first. StatCrunch does not handle spaces well.)
2. Go to **Stat** > **t-Statistics** > **Two Sample**, then **with data** or **with summary**.
3. If you chose *with data*, select the columns containing the 1st and 2nd samples. Otherwise, enter all the sample statistics.
4. Uncheck "Pool variances" and press **Next**.
5. Select "Confidence Interval" and select the confidence level.
6. Click on **Calculate**.