Example Psychologists have made extensive studies on the relationship between child abuse and later criminal behavior. Consider a study that consisted of the follow-ups of 52 boys who were abused in their preschool years and 67 boys who were not abused. The data of number of criminal offences of those boys in their teens yielded the following summary statistics:

<table>
<thead>
<tr>
<th></th>
<th>Abused</th>
<th>Non-abused</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \bar{x}_1 )</td>
<td>2.52</td>
<td>1.63</td>
</tr>
<tr>
<td>( s_1 )</td>
<td>1.84</td>
<td>1.22</td>
</tr>
</tbody>
</table>

Assume the two standard deviations are the same in both groups.

a. Determine a 95% CI for the difference between the true means for the two groups.

Sample sizes? \( n_1 = \), \( n_2 = \)

Independent samples?
Large Samples?
Variances equal?

\[ df = \]

Since df are so large (not in table), could use normal table instead:

\[ t = t \]

Note: when df > 30 use normal tables. Thus:

\[
(\bar{x}_1 - \bar{x}_2) \pm t_{.05/2,117} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}
\]

Pooled variance \( s_p^2 \)?

\[
s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = \frac{270.9}{117} = 2.315
\]

Hence, the pooled standard deviation is \( s_p = \)

Thus the 95% confidence interval for the difference in population means is

\[
(\bar{x}_1 - \bar{x}_2) \pm t_{.05/2,117} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = 0.88 \pm 0.5506 = (0.3394, 1.4406)
\]
With a probability of .95, the true mean

**Example**  (Criminal Behavior continued)

b. Is the mean number of criminal offences significantly higher for the abused group than that for the non-abused group? Use $\alpha=0.05$.

<table>
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</tr>
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<tbody>
<tr>
<td>$\bar{x}_1$</td>
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<td>1.63</td>
</tr>
<tr>
<td>$s_1$</td>
<td>1.84</td>
<td>1.22</td>
</tr>
<tr>
<td>$n_1$</td>
<td>52</td>
<td>67</td>
</tr>
</tbody>
</table>

$s_p = \sqrt{2.315} = 1.52$ and $df=117$.

$H_0 :$  
$H_a :$  
Independent samples?  
Large Samples?  
equality of standard deviations?

Hence, the test statistics to use is:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p} = \frac{0.89}{0.2809} = 3.1682$$

$\alpha =$

Reject $H_0$ if $t$.

Conclusion:  
There is
c. Calculate the p-value associated with the test in part (b).

\[ p\text{-value? (One tail test)} \]

\[ p\text{-value} = \Pr \approx \Pr = = 0.0008 \]

Since \( p\text{-value} = 0.0008 \), \( \alpha = 0.05 \),

\[ d. \text{Is the mean number of criminal offences different for the abuse group than that for the non-abused group? Use } \alpha = 0.05. \]

\[ H_0 : \]
\[ H_a : \]

Test Statistics?

\[ \alpha = \]

\[ e. \text{Calculate the p-value associated with the test in (d).} \]

\[ p\text{-value? (two tail test)} \]

\[ p\text{-value} = \approx = = 0.0016. \]

\[ p\text{-value}=0.0016 \text{ then} \]