Student’s t Test

Null Hypothesis

____________________________________________________________________________________
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Alternative Hypothesis

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____________________________________________________________________________________

Enter your data in the table below (x<sub>1</sub> and x<sub>2</sub>) then square the individual observations to give x<sub>1</sub><sup>2</sup> and x<sub>2</sub><sup>2</sup> values.

<table>
<thead>
<tr>
<th>Observation number</th>
<th>Site 1</th>
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<th>Site 2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>x&lt;sub&gt;1&lt;/sub&gt;</td>
<td>x&lt;sub&gt;1&lt;/sub&gt;&lt;sup&gt;2&lt;/sup&gt;</td>
<td>x&lt;sub&gt;2&lt;/sub&gt;</td>
<td>x&lt;sub&gt;2&lt;/sub&gt;&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>20</td>
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<tr>
<td>Σ (sum)</td>
<td>Σx&lt;sub&gt;1&lt;/sub&gt;</td>
<td>Σx&lt;sub&gt;1&lt;/sub&gt;&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Σx&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Σx&lt;sub&gt;2&lt;/sub&gt;&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Σ = the sum of, so to calculate the Σx<sub>1</sub>, Σx<sub>1</sub><sup>2</sup>, Σx<sub>2</sub>, Σx<sub>2</sub><sup>2</sup> values add up the values in each column.

Calculate the means of the x<sub>1</sub> and x<sub>2</sub> values to 3 decimal places:

\[
\bar{x}_1 = \frac{\sum x_1}{n_1} \\
\bar{x}_2 = \frac{\sum x_2}{n_2}
\]

Note that \( n \) = the number of observations and \( \bar{x} \) = the mean of the observations.

| Σx<sub>1</sub> | Σx<sub>1</sub><sup>2</sup> | Σx<sub>2</sub> | Σx<sub>2</sub><sup>2</sup> | \( \bar{x}_1 \) | \( \bar{x}_2 \) |
Calculate the Variances $s_1^2$ and $s_2^2$ to 3 decimal places in the boxes below.

$$S_1^2 = \frac{\sum x_1^2 - (\sum x_1)^2}{n_1 - 1} = \phantom{00000000}$$

$$S_2^2 = \frac{\sum x_2^2 - (\sum x_2)^2}{n_2 - 1} = \phantom{00000000}$$

Calculate your $t$ value by using the equation below (to 3 decimal places)

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \phantom{00000000}$$

For the top part of the last formula, the vertical line indicates that you take the positive value of the difference between the means.

Calculate your combined degrees of freedom $n_1 + n_2 - 2 = \phantom{00000000}$

Now look up your critical value of $t$ on the table below

<table>
<thead>
<tr>
<th>Combined degrees of freedom</th>
<th>Critical value of $t$</th>
<th>Combined degrees of freedom</th>
<th>Critical value of $t$</th>
<th>Combined degrees of freedom</th>
<th>Critical value of $t$</th>
<th>Combined degrees of freedom</th>
<th>Critical value of $t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2.571</td>
<td>13</td>
<td>2.160</td>
<td>21</td>
<td>2.080</td>
<td>29</td>
<td>2.045</td>
</tr>
<tr>
<td>6</td>
<td>2.447</td>
<td>14</td>
<td>2.145</td>
<td>22</td>
<td>2.074</td>
<td>30</td>
<td>2.042</td>
</tr>
<tr>
<td>7</td>
<td>2.365</td>
<td>15</td>
<td>2.132</td>
<td>23</td>
<td>2.069</td>
<td>35</td>
<td>2.030</td>
</tr>
<tr>
<td>8</td>
<td>2.306</td>
<td>16</td>
<td>2.120</td>
<td>24</td>
<td>2.064</td>
<td>40</td>
<td>2.021</td>
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<tr>
<td>9</td>
<td>2.262</td>
<td>17</td>
<td>2.110</td>
<td>25</td>
<td>2.060</td>
<td>45</td>
<td>2.014</td>
</tr>
<tr>
<td>10</td>
<td>2.228</td>
<td>18</td>
<td>2.101</td>
<td>26</td>
<td>2.056</td>
<td>50</td>
<td>2.010</td>
</tr>
<tr>
<td>11</td>
<td>2.201</td>
<td>19</td>
<td>2.093</td>
<td>27</td>
<td>2.052</td>
<td>60</td>
<td>2.000</td>
</tr>
<tr>
<td>12</td>
<td>2.179</td>
<td>20</td>
<td>2.086</td>
<td>28</td>
<td>2.049</td>
<td>70</td>
<td>1.994</td>
</tr>
</tbody>
</table>

If your calculated $t$ value is greater than or equal to your critical value of $t$, you can reject your null hypothesis and accept your alternative Hypothesis

We therefore Accept/Reject our Null Hypothesis  We therefore Accept/Reject our Alternative Hypothesis