Paired t-test Example Solutions

A) Thirty sets of identical twins were enrolled in a study to measure the effect of home environment on certain social attitudes. One twin in each set was randomly assigned to a minority environment or a home environment. The twin assigned to the minority environment went to live with an African American family for a period of 1 year. At the end of the year, an attitudinal survey was administered. The data along with some descriptive statistics follow. Let alpha = 0.025 and test the hypothesis that living in the minority environment leads to higher scores on the attitudinal survey.

1) How can you tell that this is a paired experiment?
   One clue that this is a Paired Experiment is that the investigator has used sets of twins. Typically, when this is done the analysis will be based on the differences between sets of scores rather than differences between the averages of one group versus the other.

2) Ho: \( \mu_d \leq 0 \)
   Ha: \( \mu_d > 0 \)

3) \( \alpha = 0.025 \quad \text{df} = 29 \quad \text{t-crit} = 2.045 \)

4) t-calc :
   variance = \( s^2 = 1236.6/29 = 42.64 \)
   standard deviation = \( \sqrt{42.64} = 6.53 \)
   SE mean = \( 6.53/\sqrt{30} = 1.19 \)
   \( \bar{x} = 138/30 = 4.6 \)
   \( t-calc = 4.6/1.19 = 3.86 \)

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Note: \( \Sigma \text{diff} = 138, \quad \text{SS}_{\text{diff}} = 1236.6, \quad \text{Diff} = \text{Minor} - \text{Home} \)
5) The decision graphic is:

![Decision Graphic](image)

6) The statistical decision is:

Reject Ho

7) The English interpretation is:

At a significance level of 0.025 there is enough evidence to support the claim that living in a minority environment leads to higher scores on the attitudinal survey.

8) Construct a 99% CI for the true average difference in attitudinal scores achieved by subjects living in the two different environments.

\[ \mu_d = \bar{d} \pm t \cdot SE \]

\[ = 4.6 \pm 2.756 (1.19) \]

\[ = 4.6 \pm 3.28 \]

\[ = (1.32, 7.88) \]

We are 99% confident that the true average “attitude” difference between living environments is between 1.32 and 7.88. At a significance level of 0.01 we can say that living in a minority environment is associated with higher scores.