ICCPP-STATISTICS
- Independent Samples T Test

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William Sealy Gosset (1876-1937)

Independent Samples T Test

Definition

- The independent samples t test (also called the unpaired samples t test) is the most common form of the T test. It helps you to compare the means of two sets of data.

Independent Samples T Test

$$t = \frac{\mu_A - \mu_B}{\sqrt{\left[\frac{\left(\Sigma A^2 - \frac{(\Sigma A)^2}{n_A}\right) + \left(\Sigma B^2 - \frac{(\Sigma B)^2}{n_B}\right)}{n_A + n_B - 2}\right] \cdot \left[\frac{1}{n_A} + \frac{1}{n_B}\right]}}$$

T Test types

One sample t test: used to compare a result to an expected value.

Paired t test (dependent samples): used to compare related observations.

You should use this test when:

- You do not know the population mean or standard deviation.
- You have two independent, separate samples.

Assumptions

1.

Assumption of Independence: you need two independent, categorical groups that represent your independent variable.

Assumptions

2.

Assumption of normality: the dependent variable should be approximately normally distributed. The dependent variable should also be measured on a continuous scale.

Assumptions

3.

Assumption of Homogeneity of Variance: The variances of the dependent variable should be equal.

Example

Calculate an independent samples t test for the following data sets:

Data set A: 1,2,2,3,3,4,4,5,5,6

Data set B: 1,2,4,5,5,5,6,6,7,9

Solution Step Wise

Step 1

Sum the two groups:

A: 1 + 2 + 2 + 3 + 3 + 4 + 4 + 5 + 5 + 6 = 35

B: 1 + 2 + 4 + 5 + 5 + 5 + 6 + 6 + 7 + 9 = 50

Solution Step Wise

Step 2

Square the sums from Step 1:

$35^2 = 1225$

$49^2 = 2500$

Set these numbers aside for a moment

Solution Step Wise

Step 3
Calculate the means for the two groups:

A: (1 + 2 + 2 + 3 + 3 + 4 + 4 + 5 + 5 + 6)/10 = 35/10 = 3.5

B: (1 + 2 + 4 + 5 + 5 + 5 + 6 + 6 + 7 + 9) = 50/10 = 5

Set these numbers aside for a moment.

Solution Step Wise

Step 4

Square the individual scores and then add them up:

A: $1^1 + 2^2 + 2^2 + 3^3 + 3^3 + 4^4 + 4^4 + 5^5 + 5^5 + 6^6 = 145$

B: $1^2 + 2^2 + 4^4 + 5^5 + 5^5 + 5^5 + 6^6 + 6^6 + 7^7 + 9^9 = 298$

Set these numbers aside for a moment.

Solution Step Wise

Step 5

Insert your numbers into the following formula and solve:

$$t = \frac{\mu_A - \mu_B}{\sqrt{\left[\frac{\left(\Sigma A^2 - \frac{(\Sigma A)^2}{n_A}\right) + \left(\Sigma B^2 - \frac{(\Sigma B)^2}{n_B}\right)}{n_A + n_B - 2}\right] \cdot \left[\frac{1}{n_A} + \frac{1}{n_B}\right]}}$$

+

Solution Step Wise

$(\Sigma A)^2$:	Sum of data set A, squared (Step 2)
$(\Sigma B)^2$:	Sum of data set B, squared (Step 2)
μ A:	Mean of data set A (Step 3)
μ B:	Mean of data set B (Step 3)
Σ A2:	Sum of the squares of data set A (Step 4)
Σ B2:	Sum of the squares of data set B (Step 4)
nA:	Number of items in data set A
nB:	Number of items in data set B

Solution Step Wise

Insert your numbers into the following formula and solve:

$$t = \frac{3.5 - 5}{\sqrt{\left[\frac{\left(145 - \frac{1225}{10}\right) + \left(298 - \frac{2500}{10}\right)}{10 + 10 - 2}\right] \cdot \left[\frac{1}{10} + \frac{1}{10}\right]}}$$

$$t = \frac{-1.5}{\sqrt{\left[\frac{\left(145 - 122.5\right) + \left(298 - 250\right)}{18}\right] \cdot \left[\frac{2}{10}\right]}}$$

$$t = \frac{-1.5}{\sqrt{3.917 \cdot \frac{2}{10}}} = \frac{-1.5}{\sqrt{0.783}} = -1.69$$

Solution Step Wise

Step 6

Find the Degrees of freedom

$$(nA-1 + nB-1) = 18$$

+

Solution Step Wise

Step 7

Look up your degrees of freedom in the t-table. If you don't know what your alpha level is, use 5% (0.05).

18 degrees of freedom at an alpha level of 0.05 = 2.10

Solution Step Wise

Step 8

Compare your calculated value (Step 5) to your table value (Step 7). The calculated value of -1.79 is less than the cutoff of 2.10 from the table.
Therefore $p > .05$.

As the p-value is greater than the alpha level, we cannot conclude that there is a difference between means.

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