

One sample t-TEST:

A CASE STUDY: Student Score Data

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A one-sample t-test is a statistical test used to determine whether the mean of a single sample of observations differs significantly from a hypothesized population mean, or a specified value.

When to Use a One-Sample t-Test:

You would typically use a one-sample t-test in the following scenarios:

1. Comparing a Sample Mean to a Population Mean:

- You have a sample of observations and you want to test whether the mean of this sample is significantly different from a known population mean (μ).

2. Comparing a Sample Mean to a Specified Value:

- You have a sample of observations and you want to test whether the mean of this sample is significantly different from a specific hypothesized value (μ_0).

Steps to Conduct a One-Sample t-Test:

Here are the basic steps involved in conducting a one-sample t-test:

1. State the Hypotheses:

- Null Hypothesis (H_0): The mean of the sample is equal to the population mean or the specified value ($\mu = \mu_0$).

- Alternative Hypothesis (H_1): The mean of the sample is not equal to the population mean or the specified value ($\mu \neq \mu_0$).

2. Collect Data and Calculate Sample Mean:

- Obtain a sample of observations and calculate the sample mean ($\bar{x}$)

3. Calculate the t-Statistic:

- Calculate the t-statistic using the formula:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

where:

- $\bar{x}$ is the sample mean,
- μ_0 is the hypothesized population mean or specified value,
- s is the standard deviation of the sample,
- n is the number of observations in the sample.

4. Determine Degrees of Freedom:

- Degrees of freedom (df) for a one-sample t-test is $n-1$, where n is the sample size.

5. Find Critical Value or p -value:

- Determine the critical value from the t-distribution table or use software to find the p -value associated with the t-statistic.

6. Make a Decision:

- Compare the calculated t-statistic to the critical value (for a given significance level) or compare the p -value to the chosen significance level (e.g., 0.05).
- If the absolute value of the t-statistic is greater than the critical value, or if the p -value is less than the significance level, then you reject the null hypothesis and conclude that there is a statistically significant difference between the sample mean and the population mean or specified value.

Assumptions of the One-Sample t-Test:

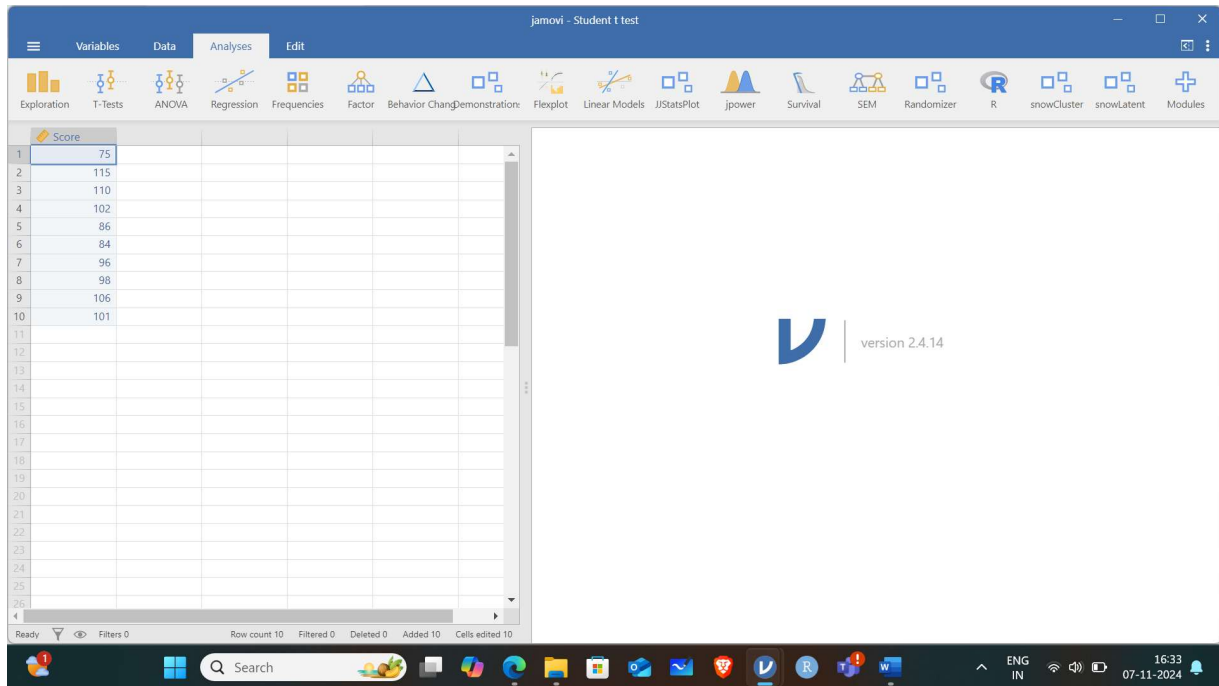
- The observations are independent.
- The sample is drawn from a normally distributed population (or the sample size is large enough for the Central Limit Theorem to apply).
- The data are interval or ratio scale.

The Problem

This test helps determine if there is sufficient evidence to reject the null hypothesis and conclude that the mean marks of the students is significantly differ from 110.

Data

Download **Student t test Data** file form the given link <https://dsdhakre.in/Datafiles.html>



Hypothesis

H_0 : Population Mean ($\mu = 110$).

H_1 : Population Mean ($\mu \neq 110$).

Steps

The screenshot shows the Jamovi software interface with the 'Analyses' menu open, highlighting 'One Sample T-Test'. The 'Dependent Variables' list contains 'Score'. The 'Tests' section has 'Student's' checked. The 'Hypothesis' section has 'Test value' selected with a value of 110. The 'Assumption Checks' section has 'Normality test' and 'Q-Q Plot' checked. The 'Results' panel displays the following tables:

One Sample T-Test

	Statistic	df	p	
Score	Student's t	-3.23	9.00	0.010

Note: $H_0: \mu \neq 110$

Normality Test (Shapiro-Wilk)

	W	p
Score	0.966	0.852

Note: A low p-value suggests a violation of the assumption of normality.

Descriptives

	N	Mean	Median	SD	SE
Score	10	97.3	99.5	12.4	3.93

This screenshot is identical to the one above, showing the same Jamovi interface with the 'One Sample T-Test' analysis setup and results. The 'Analyses' menu is open, and the 'Results' panel displays the same statistical output as the first screenshot.

One Sample T-Test

		Statistic	df	p
Score	Student's t	-3.23	9.00	0.010

Note. $H_a: \mu \neq 110$

Normality Test (Shapiro-Wilk)

	W	p
Score	0.966	0.852

Note. A low p-value suggests a violation of the assumption of normality

Since p is significant it means Data is normal if data is not normal than we use Wilcoxon rank test here

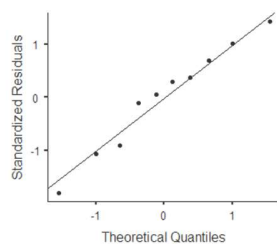
Descriptives

	N	Mean	Median	SD	SE
Score	10	97.3	99.5	12.4	3.93

Plots



Q-Q plots



Reporting

Test variable	Mean	Sd	SE	df	statistic	sig
Test Score	97.3	12.4	3.93	9	-3.23	0.010

So, the p-value found significant at 1% level of significance, Hence Null hypothesis H_0 is rejected. Here, the population mean marks is not equal to 110. Hence **Students are getting marks may be less than or greater than 110.**

Do your self

Download **one sample t test-2** file form the given link <https://dsdhakre.in/Datafiles.html>