How to Perform a One Sample t-Test to Compare a Sample Mean to a Known Value

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March 12, 2026

A one sample t-test is a statistical test used to determine if the mean of a single sample differs significantly from a known population mean. It is commonly used when the population standard deviation is unknown. The formula for a one sample t-test is t = (x? - μ) / (s/√n), where x? is the sample mean, μ is the population mean, s is the sample standard deviation, and n is the sample size. An example of a one sample t-test would be testing whether the average weight of a sample of 50 people is significantly different from the average weight of the population.

One Sample t-test: Definition, Formula, and Example

A one sample t-test is used to test whether or not the mean of a is equal to some value.

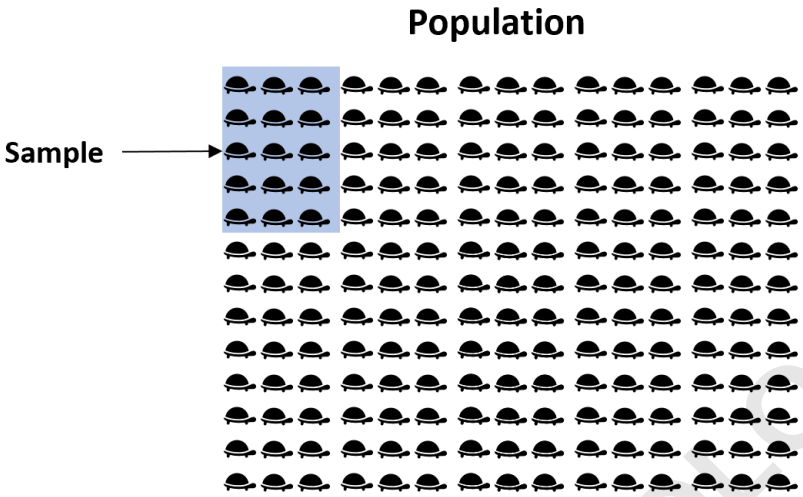
This tutorial explains the following:

The motivation for performing a one sample t-test.The formula to perform a one sample t-test.The assumptions that should be met to perform a one sample t-test.An example of how to perform a one sample t-test.

One Sample t-test: Motivation

Suppose we want to know whether or not the mean weight of a certain species of turtle in Florida is equal to 310 pounds. Since there are thousands of turtles in Florida, it would be extremely time-consuming and costly to go around and weigh each individual turtle.

Instead, we might take a of 40 turtles and use the mean weight of the turtles in this sample to estimate the true population mean:



However, it's virtually guaranteed that the mean weight of turtles in our sample will differ from 310 pounds. The question is whether or not this difference is statistically significant. Fortunately, a one sample t-test allows us to answer this question.

One Sample t-test: Formula

A one-sample t-test always uses the following null hypothesis:

H0: $\mu = \mu 0$ (population mean is equal to some hypothesized value $\mu 0$)

The alternative hypothesis can be either two-tailed, left-tailed, or right-tailed:

H1 (two-tailed): μ ? μ0 (population mean is not equal to some hypothesized value μ0)H1 (left-tailed): μ < μ (population mean is less than some hypothesized value μ0)H1 (right-tailed): μ > μ0 (population mean is greater than some hypothesized value μ0)

We use the following formula to calculate the test statistic t:

t = (x - μ) / (s/√n)

where:

x: sample meanμ0: hypothesized population means: sample standard deviationn: sample size

One Sample t-test: Assumptions

For the results of a one sample t-test to be valid, the following assumptions should be met:

The variable under study should be either an .The observations in the sample should be .The variable under study should be approximately normally

distributed. You can check this assumption by creating a histogram and visually checking if the distribution has roughly a "bell shape."The variable under study should have no outliers. You can check this assumption by creating a and visually checking for outliers.

One Sample t-test: Example

Suppose we want to know whether or not the mean weight of a certain species of turtle is equal to 310 pounds. To test this, will perform a one-sample t-test at significance level $\alpha = 0.05$ using the following steps:

Step 1: Gather the sample data.

Suppose we collect a random sample of turtles with the following information:

Sample size n = 40Sample mean weight x = 300Sample standard deviation s = 18.5

Step 2: Define the hypotheses.

We will perform the one sample t-test with the following hypotheses:

H0: μ = 310 (population mean is equal to 310

pounds)H1: μ ? 310 (population mean is not equal to 310 pounds)

Step 3: Calculate the test statistic *t*.

t = (x - μ) / (s/√n) = (300-310) / (18.5/√40) = -3.4187

Step 4: Calculate the p-value of the test statistic *t*.

According to the , the p-value associated with t = -3.4817 and degrees of freedom = n-1 = 40-1 = 39 is 0.00149.

Step 5: Draw a conclusion.

Since this p-value is less than our significance level α = 0.05, we reject the null hypothesis. We have sufficient evidence to say that the mean weight of this species of turtle is not equal to 310 pounds.

Note: You can also perform this entire one sample t-test by simply using the .

The following tutorials explain how to perform a one-sample t-test using different statistical programs:

How to Conduct a One Sample t-test in Python

How to Perform a One Sample t-test on a TI-84 Calculator