

What is the definition, formula, and an example of a One Sample Z-Test?

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A One Sample Z-Test is a statistical analysis method used to determine if a sample mean is significantly different from a known population mean. This test is based on the normal distribution and requires a large sample size (typically 30 or more observations). The formula for a One Sample Z-Test is $(\bar{x} - \mu) / (\sigma / \sqrt{n})$, where $\bar{x}$ is the sample mean, μ is the population mean, σ is the population standard deviation, and n is the sample size. An example of a One Sample Z-Test would be testing if the average height of a sample of students is significantly different from the known average height of the entire student population.

One Sample Z-Test: Definition, Formula, and Example

A one sample z-test is used to test whether the mean of a population is less than, greater than, or equal to some specific value.

This test assumes that the population standard deviation is known.

This tutorial explains the following:

The formula to perform a one sample z-test. The assumptions of a one sample z-test. An example of how to perform a one sample z-test.

Let's jump in!

One Sample Z-Test: Formula

A one sample z-test will always use one of the following null and alternative hypotheses:

1. Two-Tailed Z-Test

H0: $\mu = \mu_0$ (population mean is equal to some hypothesized value μ_0)
HA: $\mu \neq \mu_0$ (population mean is not equal to some hypothesized value μ_0)

2. Left-Tailed Z-Test

H0: $\mu \geq \mu_0$ (population mean is greater than or equal to some hypothesized value μ_0)
HA: $\mu < \mu_0$ (population mean is less than some hypothesized value μ_0)

3. Right-Tailed Z-Test

H0: $\mu \leq \mu_0$ (population mean is less than or equal to some hypothesized value μ_0)
HA: $\mu > \mu_0$ (population mean is greater than some hypothesized value μ_0)

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

$$z = (x - \mu_0) / (\sigma / \sqrt{n})$$

where:

x: sample mean **μ_0 :** hypothesized population mean **σ :**

population standard deviation: sample size

One Sample Z-Test: Assumptions

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

The data are continuous (not discrete). The data is a random sample from the population of interest. The data in the population is approximately normally distributed. The population standard deviation is known.

One Sample Z-Test: Example

Suppose the IQ in a population is normally distributed with a mean of $\mu = 100$ and standard deviation of $\sigma = 15$.

A scientist wants to know if a new medication affects IQ levels, so she recruits 20 patients to use it for one month and records their IQ levels at the end of the month:

To test this, she will perform a one sample z-test at significance level $\alpha = 0.05$ using the following steps:

Step 1: Gather the sample data.

Suppose she collects a simple random sample with the following information:

$$n \text{ (sample size)} = 20 \times (\text{sample mean IQ}) = 103.05$$

Step 2: Define the hypotheses.

She will perform the one sample z-test with the following hypotheses:

$$H_0: \mu = 100 \quad H_A: \mu \neq 100$$

Step 3: Calculate the z test statistic.

The z test statistic is calculated as:

$$z = (x - \mu) / (\sigma / \sqrt{n}) \quad z = (103.05 - 100) / (15 / \sqrt{20}) \quad z = 0.90933$$

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

According to the , the two-tailed p-value associated with $z = 0.90933$ is 0.36318.

Step 5: Draw a conclusion.

Since the p-value (0.36318) is not less than the significance level (.05), the scientist will fail to reject the

null hypothesis.

There is not sufficient evidence to say that the new medication significantly affects IQ level.

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

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