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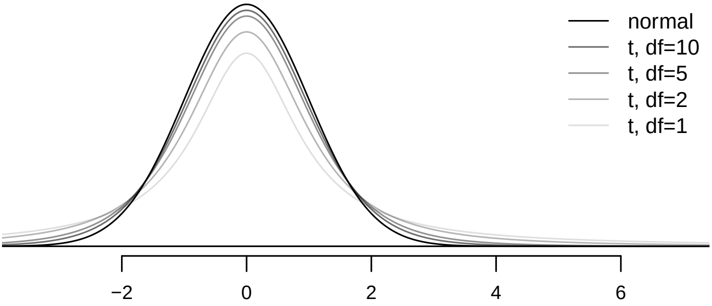

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Example confidence interval of single sample with small n, unknown σ.

A random sample of size $n = 10$ was collected from a population which is believed to be approximately symmetric. The sample has a mean $\bar{x} = 135.7$ and standard deviation $s = 24.6$. Find the confidence interval with a confidence level $\gamma = 0.95$.

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$$CI = 135.7 \pm (2.26)(7.78)$$

$$CI = (118.1,\ 153.3)$$

Practice: confidence interval, single small sample, unknown σ

A random sample of size $n = 15$ was collected from a population which is believed to be approximately symmetric. The sample has a mean $\bar{x} = 11.1$ and standard deviation $s = 2.3$. Find the confidence interval with a confidence level $\gamma = 0.99$.

Practice: confidence interval, single small sample, unknown σ

A random sample of size $n = 15$ was collected from a population which is believed to be approximately symmetric. The sample has a mean $\bar{x} = 11.1$ and standard deviation $s = 2.3$. Find the confidence interval with a confidence level $\gamma = 0.99$.

$$SE = \frac{2.3}{\sqrt{15}} = 0.594$$

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$$CI = (9.33,\ 12.87)$$

Working backwards: confidence intervals

A 90% confidence interval for a population mean, μ, is given as (43.84, 55.92). This confidence interval is based on a simple random sample of 12 observations. Calculate the sample mean and standard deviation. Assume that all conditions necessary for inference are satisfied. Use the T distribution in any calculations.

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$$SE = \frac{6.04}{1.8} = 3.3564258$$

continued on next frame...

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Thus, the sample mean is 49.88 and the sample standard deviation is 11.63.

Practice: working backwards with confidence intervals

A 95% confidence interval for a population mean, μ, is given as (88.09, 109.15). This confidence interval is based on a simple random sample of 9 observations. Calculate the sample mean and standard deviation. Assume that all conditions necessary for inference are satisfied. Use the T distribution in any calculations.

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$$s = (4.56)\sqrt{9} = 13.68$$

Hypothesis testing with single small sample

You will perform a single-sample t test of the null hypothesis claiming $\mu = 22$. Before collecting the sample, you decide to use a two-tail test with a significance level $\alpha = 0.05$. The sample has the following attributes:

$$\begin{aligned} n &= 11 \\ \bar{x} &= 15.49 \\ s &= 8.03 \end{aligned}$$

What is your conclusion?

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$$SE = \frac{s}{\sqrt{n}} = \frac{8.03}{\sqrt{11}} = 2.421$$

continued on next slide...

We calculate the t score (same way as with z testing).

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For the T table, we use the absolute value of t...

$$t = 2.69$$

We determine the degrees of freedom.

$$df = n - 1 = 10$$

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We compare the p-value to α.

$$p\text{-value} < \alpha$$

We make our conclusion: we reject the null.

Practice:

You will perform a single-sample t test of the null hypothesis claiming $\mu = 140$. Before collecting the sample, you decide to use a two-tail test with a significance level $\alpha = 0.1$. The sample has the following attributes:

$$\begin{aligned} n &= 3 \\ \bar{x} &= 193.06 \\ s &= 52.22 \end{aligned}$$

What is your conclusion?

We state the hypotheses:

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$$H_0 : \quad \mu = 140$$

$$H_A : \quad \mu \neq 140$$

We state the hypotheses:

$$H_0 : \quad \mu = 140$$

$$H_A : \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We state the hypotheses:

$$H_0 : \quad \mu = 140$$

$$H_A : \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We state the hypotheses:

$$H_0 : \quad \mu = 140$$

$$H_A : \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We estimate the p-value from the T table.

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We estimate the p-value from the T table.

$$0.2 < p\text{-value} < 0.5$$

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We estimate the p-value from the T table.

$$0.2 < p\text{-value} < 0.5$$

We compare the p-value to α.

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We estimate the p-value from the T table.

$$0.2 < p\text{-value} < 0.5$$

We compare the p-value to α.

$$p\text{-value} > \alpha$$

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We estimate the p-value from the T table.

$$0.2 < p\text{-value} < 0.5$$

We compare the p-value to α.

$$p\text{-value} > \alpha$$

We make our conclusion:

We state the hypotheses:

$$H_0: \quad \mu = 140$$

$$H_A: \quad \mu \neq 140$$

We estimate the standard error (same way as with z testing).

$$SE = \frac{s}{\sqrt{n}} = \frac{52.22}{\sqrt{3}} = 30.149$$

We calculate the t score (same way as with z testing).

$$t = \frac{193.06 - 140}{30.149} = 1.76$$

We determine the degrees of freedom.

$$df = n - 1 = 2$$

We estimate the p-value from the T table.

$$0.2 < p\text{-value} < 0.5$$

We compare the p-value to α.

$$p\text{-value} > \alpha$$

We make our conclusion: we retain the null.