M358K: November 13th, 2023.

Single Sample t·Procedures.

It is essential that either the sample is large ($n \geq 30$), or if the sample is small there needs to be evidence of normality.

To check for normality:

- histogram
- box plot
- qq plot
- Shapiro·Wilk

Confidence Intervals for μ.

C … confidence level

pt.estimate $\pm$ margin·of·error

$t^*(df=n-1) \cdot \text{stderror}$, where stderror $= \frac{s}{\sqrt{n}}$

$$\bar{x} \pm t^*(df=n-1) \cdot \frac{s}{\sqrt{n}}$$

In R: $t^*(df=n-1)$ is $qt\left(\frac{1+C}{2}, df=n-1\right)$

Problem. [Ramachandran·Tsokos]

The scores of a random sample of 16 had a sample mean of 540 and a sample standard deviation of 50.
Assume that the scores come from a normal population.
Construct a 95% confidence interval for the population mean μ.

$\longrightarrow$: $n=16$; $\bar{x}=540$; $s=50$

$t^*(df=15) = 2.131$ or $qt(\underbrace{(1+0.95)/2}_{0.975 \text{ lower tail}}, df=15) = 2.13145$

95% confidence $\Rightarrow$ 0.025 upper tail standard error : $\frac{s}{\sqrt{n}} = \frac{50}{\sqrt{16}} = \frac{50}{4} = 12.5$

margin of error : $2.131\,(12.5) = 26.6375$

$\Rightarrow$ $\boxed{\mu = 540 \pm 26.6375}$

or

$CI = (\underline{513.3625}, \underline{566.6375})$

or

$513.3625 < \mu < 566.6375$ $\square$

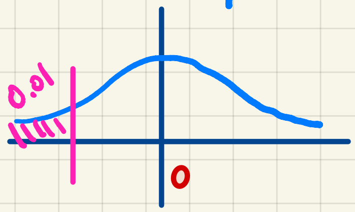
Problem. Every jar of Nocciolata is labeled to contain 270g of delicious hazelnut spread.
You suspect that the amount in every jar is actually less.
You do some research and you are comfortable assuming that the amount of spread per jar is normal w/ a known std deviation of $\boxed{10g}$.
You plan to collect 64 jars and weigh their contents.
What is the form of your RR in raw units w/ $\alpha = 0.01$?

$\longrightarrow$: $H_0: \mu = \mu_0 = \underline{270}$ vs. $H_a: \mu < \mu_a = 270$

The form of the rejection region:

$$RR = [0, \underline{\mu_0 + z_\alpha \cdot \tfrac{\sigma}{\sqrt{n}}}]$$

$$z_\alpha = \text{qnorm}(0.01) = -2.33$$



$$RR = \left[0, 270 + (-2.33)\cdot\frac{10}{\sqrt{64}}\right] =$$

$$= [0, 270 - 2.9125] = [0, 267.0875]$$

In R: 270+qnorm(0.01)*10/sqrt(64) = 267.0921 $\square$