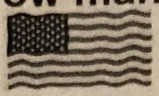
Learning Targets

- Construct and interpret a confidence interval for a population mean.
- Determine the sample size required to obtain a C% confidence interval for a population mean with a specified margin of error.

Lesson 8.3: Day 2: How many states can you name?



How many states can you name in one minute? We will use this class as a random sample of all AP Stats students to estimate a 95% confidence interval for the mean number of states an AP Stats student can name in one minute.

1. When the timer starts, list as many states as you can on a piece of paper. Write the number of states you listed on the board.

Categorical → proportions

2. What type of data is this? Categorical or quantitative? Quantitative → means

2. Enter the class data at stapplet.com. Find the sample mean and standard deviation. Sketch the dotplot of the sample data.

$n =$ $\bar{x} =$ $s_x =$

3. Construct a 95% confidence interval to estimate the mean # of states a senior can name.

STATE: State the parameter you want to estimate and the confidence level.

We want to estimate μ the true mean # of states a high school senior can name in one minute at a 95% confidence level.

PLAN: Identify the appropriate inference method and check conditions.

Name of procedure: one sample t interval for μ

Check conditions:

- Random ✓
Random sample AP Students ✓

- 10% (Independent)
10n < pop of all HS Seniors
Reasonable to assume ✓

- Normal:
n ≥ 30 CLT
or
Sample shows no strong skew or outliers

DO: If the conditions are met, perform the calculations.

General Formula for any confidence interval: Point Estimate ± Margin of Error

Specific Formula for this confidence interval: $\bar{x} \pm t^* \frac{s_x}{\sqrt{n}}$

Plug numbers into the formula:

Answer:

CONCLUDE: Interpret your interval in the context of the problem.

Interpret: We are 95% confident that the interval from ___ to ___ captures the true mean # of states a senior can name in 1 minute.

Name: _____ Hour: ____ Date: ____

Lesson 8.3 Day 2 – The Four Step Process

Important ideas:

L.T. #1 4-Steps (Changes)

State: We want to estimate μ the true mean of _____ at a ____% confidence level.

Plan: one sample t interval for μ

✓Conditions

Normal Condition

- Pop. is Normal
- $n \geq 30$, CLT
- sample shows no strong skew or outliers

this makes inference about the shape of the population from which the sample came from.

Do: Point Estimate ± M.E

$\bar{x} \pm t^* \frac{s_x}{\sqrt{n}}$

Conclude: - in context

L.T. #2 Sample Size

$\text{Margin of Error} \geq t^* \frac{s_x}{\sqrt{n}}$

use z^* in place of t^* is σ is known.

if σ known, $ME \geq z^* \frac{\sigma}{\sqrt{n}}$ can use this to find sample size n

Check Your Understanding

1. Administrators at your school want to estimate how much time students spend on homework, on average, during a typical week. They want to estimate μ at the 90% confidence level with a margin of error of at most 30 minutes. A pilot study indicated that the standard deviation of time spent on homework per week is about 154 minutes. How many students need to be surveyed to meet the administrators' goal?

ME at most 30 min

$\sigma = 154$ min ← since we know σ, we will use z^*

$n = ?$

$z^*_{90\%} = \text{invNorm}(.05) = 1.645$

$30 \geq 1.645 \left(\frac{154}{\sqrt{n}}\right)$

$\frac{30}{1.645} \geq \frac{154}{\sqrt{n}}$

$\sqrt{n} \geq \frac{154}{(30/1.645)}$

$n \geq \left(154/(30/1.645)\right)^2$

$n \geq 71.3$ at least 72 students

Name: _____ Hour: ____ Date: ____

Put data in L1 and run stats, and use calculator to make graphs

2. Biologists studying the healing of skin wounds measured the rate at which new cells closed a cut made in the skin of an anesthetized newt. Here are data from a random sample of 18 newts, measured in micrometers (millionths of a meter) per hour:

invT(.025, 17)

$t^*_{17} = 2.110$ (95%)

29 27 34 40 22 28 14 35 26 35 12 30 23 18 11 22 23 33 $\bar{x} = 25.67$

Calculate and interpret a 95% confidence interval for the mean healing rate μ. $s_x = 8.32$ $n = 18$

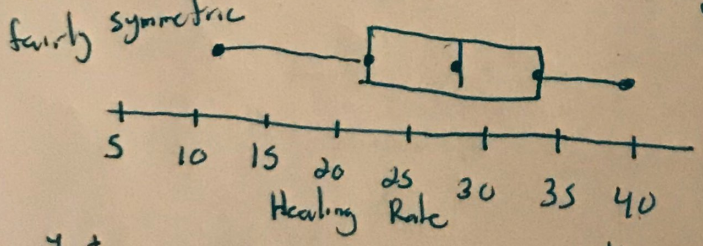
State: We want to estimate μ the true mean healing rate of a newt at a 95% confidence level.

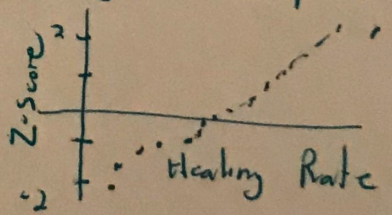
Plan: One sample t interval for μ

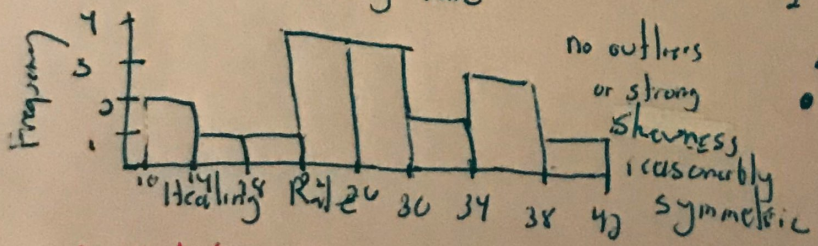
Random: random sample of 18 ✓

10% (Independent): 10(18) < pop of all newts ✓ Reasonable to assume

Normal: We do not know if the data are Normal, and there are fewer than 30 observations, so we need to graph the data to see that their is no strong skewness or outliers. (Could use dotplot, histogram, probability plot boxplot, even graphing more than one type to give a clear picture if needed)







∴ Normal, no strong skew or outliers in sample data. (This gives us reason to believe Normality in the population)

DO: Pt Est ± M.E.

$\bar{x} \pm t^* \frac{s_x}{\sqrt{n}} \rightarrow 25.67 \pm 2.110\left(\frac{8.32}{\sqrt{18}}\right) \rightarrow 25.67 \pm 4.14 \rightarrow (21.53, 29.81)$

Conclude: We are 95% confident that the interval from 21.53 to 29.81 micrometers per hour captures the true mean healing rate.

TheStatsMedic