Chapter 8 AP Statistics Practice Test

Section I: Multiple Choice *Select the best answer for each question.*

A

T8.1. The Gallup Poll interviews 1600 people. Of these, 18% say that they jog regularly. The news report adds: "The poll had a margin of error of plus or minus three percentage points at a 95% confidence level." You can safely conclude that

(a) 95% of all Gallup Poll samples like this one give answers within ±3% of the true population value.

(b) the percent of the population who jog is ~~certain~~ to be between 15% and 21%. We are never certain of the true value

(c) 95% of the ~~population~~ jog between 15% and 21% of the time. CI describes proportion NOT population

(d) we can be 95% confident that the ~~sample proportion~~ is captured by the confidence interval. CI captures true value NOT sample statistic

(e) if Gallup took many samples, 95% of them would find that 18% of the people in the sample jog.

D

T8.2. The weights (in pounds) of three adult males are 160, 215, and 195. The standard error of the mean of these three weights is → Put in L1 to find S_x

(a) 190. (b) 27.84. (c) 22.73. (d) 16.07. (e) 13.13.

SEM ⇒ $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ ← replace w/ S_x $= \frac{27.839}{\sqrt{3}} = 16.07$

C

T8.3. In preparing to construct a one-sample t interval for a population mean, suppose we are not sure if the population distribution is Normal. In which of the following circumstances would we not be safe constructing the interval based on an SRS of size 24 from the population?

(a) A stemplot of the data is roughly bell-shaped.

(b) A histogram of the data shows slight skewness.

(c) A stemplot of the data has a large outlier. ← OUTLIERS ARE THE BIGGEST THREAT TO NORMALITY

(d) The sample standard deviation is large.

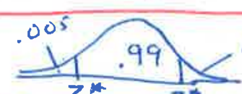
(e) The t procedures are robust, so it is always safe.

D

T8.4. Many television viewers express doubts about the validity of certain commercials. In an attempt to answer their critics, Timex Group USA wishes to estimate the proportion of consumers who believe what is shown in Timex television commercials. Let p represent the true proportion of consumers who believe what is shown in Timex television commercials. What is the smallest number of consumers that Timex can survey to guarantee a margin of error of 0.05 or less at a 99% confidence level?

(a) ~~550~~ (b) ~~600~~ (c) ~~650~~ (d) 700 (e) 750

ME = .05
99% CL → $z^* = \pm 2.576$ invNorm(.005,0,1)
p = .5 (Conservative guess)



ME = $z^* \cdot$ SD

$2.576\sqrt{\frac{(.5)(.5)}{n}} \le .05$

⇓

$\frac{2.576(.5)}{.05} \le \sqrt{n}$

$663.6 \le n$

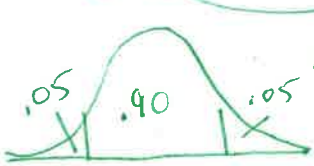
⇓

$n \geq 663.6$

B

T8.5. You want to compute a 90% confidence interval for the mean of a population with unknown population standard deviation. The sample size is 30. The value of t^* you would use for this interval is

(a) 1.645. (b) 1.699. (c) 1.697. (d) 1.96. (e) 2.045.



n = 30
df = 29

invT(.05, 29) = -1.699

A **T8.6.** A radio talk show host with a large audience is interested in the proportion p of adults in his listening area who think the drinking age should be lowered to eighteen. To find this out, he poses the following question to his listeners: "Do you think that the drinking age should be reduced to eighteen in light of the fact that eighteen-year-olds are eligible for military service?" He asks listeners to phone in and vote "Yes" if they agree the drinking age should be lowered and "No" if not. Of the 100 people who phoned in, 70 answered "Yes." Which of the following conditions for inference about a proportion using a confidence interval are violated?

$n=100$ $\hat{p}=.7$ $\hat{q}=.3$

X I. The data are a random sample from the population of interest. Voluntary sample is NOT random

✓ II. n is so large that both $n\hat{p}$ and $n(1-\hat{p})$ are at least 10. Y $n\hat{p}=70$ ✓ $n\hat{q}=30$ ✓

✓ III. The population is at least 10 times as large as the sample. Y population is at least $10(100)=1{,}000$

(a) I only (b) II only (c) III only (d) I and II only (e) I, II, and III

D **T8.7.** A 90% confidence interval for the mean μ of a population is computed from a random sample and is found to be 9 ± 3. Which of the following *could* be the 95% confidence interval based on the same data?

(a) 9 ± 1.96 (b) 9 ± 2 (c) 9 ± 3 (d) 9 ± 4
(e) Without knowing the sample size, any of the above answers could be the 95% confidence interval.

T8.7

90% CI $\rightarrow$ 9 ± 3

95% CI $\rightarrow$ $9 \pm z^* \cdot SD$

① ME increases when CL increases

90%
95%

② Do math

90% $3/1.64 = 1.8 \leftarrow SD$

then

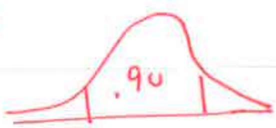
95% $1.96 * 1.8 \approx 3.5$ ↑ increased

D **T8.8.** Suppose we want a 90% confidence interval for the average amount spent on books by freshmen in their first year at a major university. The interval is to have a margin of error of \$2. Based on last year's book sales, we estimate that the standard deviation of the amount spent will be close to \$30. The number of observations required is closest to

Use z^* since SD known

(a) 25. (b) 30. (c) 608. (d) 609. (e) 865.

T8.8



ME = \$2
SD ≈ 30
$z^* = 1.645$

$$z^* \cdot \frac{SD}{\sqrt{n}} \le 2$$

$$1.645 \cdot \frac{30}{\sqrt{n}} \le 2$$

$$\left(\frac{1.645 \cdot 30}{2}\right)^2 \le \left(\sqrt{n}\right)^2$$

$$24.7^2 \le \sqrt{n}^{\,2}$$

$$608.8 \le n \qquad n \geq 608.8$$

E **T8.9.** A telephone poll of an SRS of 1234 adults found that 62% are generally satisfied with their lives. The announced margin of error for the poll was 3%. Does the margin of error account for the fact that some adults do not have telephones?

(a) Yes. The margin of error includes all sources of error in the poll.
(b) Yes. Taking an SRS eliminates any possible bias in estimating the population proportion.
(c) Yes. The margin of error includes undercoverage but not nonresponse.
(d) No. The margin of error includes nonresponse but not undercoverage.
(e) No. The margin of error only includes sampling variability.

The ME does NOT include any source of error other than sampling variability

D

T8.10. A Census Bureau report on the income of Americans says that with 90% confidence the median income of all U.S. households in a recent year was \$57,005 with a margin of error of ±\$742. This means that

(a) 90% of all households had incomes in the range \$57,005 ± \$742.

(b) we can be sure that the median income for all households in the country lies in the range \$57,005 ± \$742.

(c) 90% of the households in the sample interviewed by the Census Bureau had incomes in the range \$57,005 ± \$742.

(d) the Census Bureau got the result \$57,005 ± \$742 using a method that will cover the true median income 90% of the time when used repeatedly.

(e) 90% of all possible samples of this same size would result in a sample median that falls within \$742 of \$57,005.

(1) The interval does NOT tell us where the population median is for sure

(2) It does NOT tell us where individual incomes are

(3) The CI only provides a list of all plausible values for the population median

Section II: Free Response *Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.*

T8.11. The U.S. Forest Service is considering additional restrictions on the number of vehicles allowed to enter Yellowstone National Park. To assess public reaction, the service asks a random sample of 150 visitors if they favor the proposal. Of these, 89 say "Yes."

(a) Construct and interpret a 99% confidence interval for the proportion of all visitors to Yellowstone who favor the restrictions.

(b) Based on your work in part (a), can the U.S. Forest Service conclude that more than half of visitors to Yellowstone National Park favor the proposal? Justify your answer.

Answers to Free Response are at the end of document

T8.12. How many people live in South African households? To find out, we collected data from an SRS of 48 out of the over 700,000 South African students who took part in the CensusAtSchool survey project. The mean number of people living in a household was 6.208; the standard deviation was 2.576.

(a) Is the Normal condition met in this case? Justify your answer.

(b) Maurice claims that a 95% confidence interval for the population mean is $6.208 \pm 1.96\frac{0.372}{\sqrt{47}}$. Explain why this interval is wrong. Then give the correct interval.

T8.13. A milk processor monitors the number of bacteria per milliliter in raw milk received at the factory. A random sample of 10 one-milliliter specimens of milk supplied by one producer gives the following data:

5370 4890 5100 4500 5260 5150 4900 4760 4700 4870

Construct and interpret a 90% confidence interval for the population mean μ.

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T8.11 (a) *State*: We want to estimate the actual proportion of all visitors to Yellowstone who favor the restrictions at a 99% confidence level. *Plan*: We should use a one-sample z-interval for p if the conditions are satisfied. Random: the visitors were selected randomly. Normal: there were 89 successes (said yes) and 61 failures (said no). Both are at least 10. Independent: the sample is less than 10% of the population of all visitors to Yellowstone. The conditions are met. *Do*: A 99% confidence interval is given by $0.593 \pm 2.576\sqrt{\frac{0.593(0.407)}{150}} = (0.490, 0.696)$. *Conclude*: We are 99% confident that the interval from 0.490 to 0.696 captures the true proportion of all visitors would say that they favor the restrictions. (b) The U.S. Forest Service cannot conclude that more than half of visitors to Yellowstone National Park favor the proposal. It is plausible that only 49% favor the proposal.

p = the true proportion of visitors to Yellowstone who favor restrictions

$\hat{p} = 89/150 = .593$

TEST: 1 sample z interval for p

$z^* = \text{invNorm}(.005, 0, 1) = 2.576$

Conditions:

Random: SRS n = 150

CI: $\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

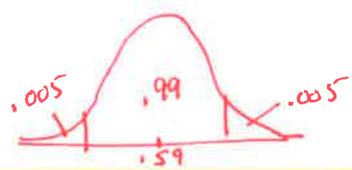
Independent: reasonable there are at least 10(150) = 1,500 visitors

$.593 \pm 2.576\sqrt{\frac{.593(.407)}{150}}$

$.593 \pm .104$

Normal: $n\hat{p} = 89 \geq 10$ ✓
$n\hat{q} = 61 \geq 10$ ✓

(.489, .697)



[STAT] [TESTS] [A: 1 PROPZINT]

(.490, .697)

See above for conclusion in context

T8.12 (a) Since the sample size is relatively large (larger than 30), the Normal condition is met. (b) ① Maurice's interval uses a z^* instead of a t^*. This would be appropriate only if we knew the population standard deviation. In this case, we do not know the population standard deviation so we need to use a t-interval. Since the sample size is 48, we use a t with 47 degrees of freedom. This gives us $t^* = 2.012$. ② Maurice also used the wrong value under the square root sign in his equation. He should have used n which is 48 rather than using 47. ③ He also used the wrong standard deviation. The interval is

$$6.208 \pm 2.012\left(\frac{2.576}{\sqrt{48}}\right) = 6.208 \pm 0.748 = (5.460, 6.956).$$

b

μ = true mean number of people live in household

$\boxed{\sigma = \text{UNKNOWN}}$

SRS n = 48   N = 700,000

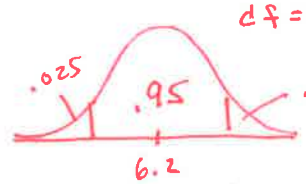
$\bar{x} = 6.208$ $S_x = 2.576$

Conditions: Random SRS n = 48
Independent 47(10) = 470 ≤ 700,00
Normal: CLT sample is large (n ≥ 30)

n = 48
df = 47

(a) See above

(b) See explaination above



TEST 1 sample t-interval for μ

Conditions (above)

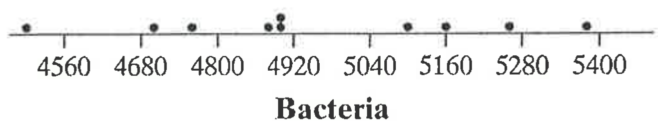
CI: $6.208 \pm 2.012\left(\frac{2.576}{\sqrt{48}}\right)$

$t^* = 2.012$
invT(.025, 47)

$6.208 \pm .748$

$\boxed{(5.460, 6.956)}$ ← [STAT] [TESTS] [T INTERVAL]

T8.13 *State*: We want to estimate the true mean number of bacteria per milliliter of raw milk μ for milk received at the factory at the 90% confidence level. *Plan*: We should construct a one-sample t-interval for μ if the conditions are met. Random: The data come from a random sample. Normal: The graph (below) indicates that there is no strong skewness or outliers. Independent: We have data from less than 10% of possible samples of milk received at the factory. The conditions are met.



Do: We compute from the differences that $\bar{x} = 4950.0$ and $s = 268.5$ and we have a sample of $n = 10$ observations. This mean that we have 9 df and $t^* = 1.833$. The confidence interval, then, is $4950.0 \pm 1.833\left(\frac{268.5}{\sqrt{10}}\right) = 4950.0 \pm 155.63 = (4794.37, 5105.63)$. *Conclude*: We are 90% confident that the interval from 4794.37 to 5105.63 bacterial/ml captures the true mean number of bacteria in the milk received at this factory.

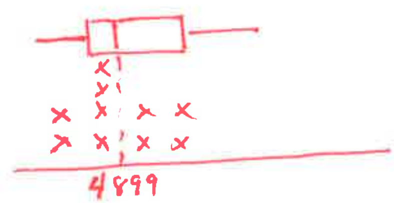
μ = true mean number of bacteria per ml of raw milk

Conditions

Random: SRS n=10

Independent: reasonable there is 10(10) = 100 or more bacteria

Normal: Sample is small so see the graph The graph of a box plot and the histogram does not show outliers or skewness and therefore nothing to say the distribution is NOT NORMAL



TEST 1 Sample t-interval for μ

$4950 \pm 1.833\left(\frac{268.45}{\sqrt{10}}\right)$

$\bar{x} = 4950$

$S_x = 268.45$

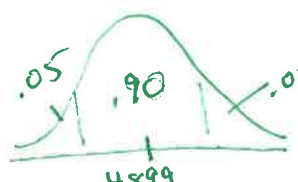
$n = 10$

$df = 9$

4950 ± 155.6

$\boxed{(4794.4,\ 5105.6)}$

See above for answer in context



[STAT] [TESTS]

[Tinterval] STATS (4794.4, 5105.6)

$t^* = 1.833$ invT(.05,9)