KEY

Chapter 8 Review Sheet

1. If the 90% confidence interval of the mean of a population is given by 45 ± 3.24, which of the following is correct?
   (a) There is a 90% probability that the true mean is in the interval.
   (b) There is a 90% probability that the sample mean is in the interval.
   (c) If 1,000 samples of the same size are taken from the population and a confidence interval is constructed around the mean of each sample, then approximately 900 of the confidence intervals will contain the true mean.
   (d) There is a 90% probability that a data value, chosen at random, will fall in this interval.
   (e) None of the above.

2. Which of the following statements about confidence intervals is not correct?
   (a) If the sample size were to increase the width of the interval would decrease.
   (b) An increase in confidence level results in an increase in the width of the confidence interval.
   (c) A confidence interval can be calculated after either a sample or a census is conducted.
   (d) If one would like a smaller confidence interval, one could increase the sample size or decrease the confidence level.
   (e) All of these are correct.

3. The choice between a z-interval and a t-interval for a population mean depends primarily on:
   (a) The sample size.
   (b) The confidence level.
   (c) Whether it uses means or proportions.
   (d) Whether the given standard deviation is from the population or the sample.
   (e) A z-test should never be used.

4. The college newspaper of a large Midwestern university periodically conducts a survey of students on campus to determine the attitude on campus concerning issues of interest. Pictures of the students interviewed along with quotes of their responses are printed in the paper. A reporter interviews five of her friends and asks them if they feel there is adequate student parking on campus. Four of the students say no. Which of the following conditions for inference about a proportion using a confidence interval are violated in this example?

   I. The data are selected randomly from the population of interest.
   II. The population is at least ten times as large as the sample.
   III. $n\hat{p} \geq 10$ and $n(1-\hat{p}) \geq 10$.

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

5. A polling organization announces that the proportion of American voters who favor congressional term limits is 64 %, with a 95% confidence margin of error of 3 %. This means that
   (a) If the poll were conducted again in the same way, there is a 95% chance that the fraction of voters favoring term limits in the second poll would be between 61 % and 67 %.
   (b) There is a 95% probability that the true percentage of voters favoring term limits is between 61 and 67%.
   (c) If the poll were conducted again the same way, there is a 95% probability that the percentage of voters favoring term limits in the second poll would be within 3 % of the percentage favoring term limits in the first poll.
   (d) Among 95% of the voters, between 61 % and 67 % favor term limits.
   (e) We are reasonably certain that the true proportion of voters favoring term limits is between 61% and 67%.

6. Will the results from t procedures always, sometimes, or never be valid:
   When the sample is not selected randomly? Never

   When the sample size is small? Sometimes – when a graph shows no outliers and no strong skewness

   When the distribution of the population is skewed? Sometimes – when CLT applies ($n \geq 30$)

   When there are outliers in the distribution of the sample data? Sometimes – when CLT applies ($n \geq 30$)

7. Suppose the heights of eighth grade girls are known to be Normally distributed. A sample of 23 eighth grade girls from Lake Wobegon is randomly selected, their heights are recorded, and then a 95% confidence interval for the average height of all eighth grade girls in Lake Wobegon is calculated. Sample data is shown in the table below.

Variable	N	Mean	StDev	SE Mean	95.0 % CI
Heights	23	62.35	?	?	(60.00, 64.69)

$df = 23 - 1 = 22$

$\downarrow$

62.345 ± 2.345

Find the standard deviation of the sample.

$$t^* \frac{s}{\sqrt{n}} = 2.345$$

$$\frac{2.074\left(\frac{s}{\sqrt{23}}\right)}{2.074} = \frac{2.345}{2.074}$$

$$\sqrt{23} \cdot \frac{s}{\sqrt{23}} = 1.13 \cdot \sqrt{23}$$

$$\boxed{s = 5.422}$$

8. A simple random sample of 100 eighth graders at a large suburban middle school indicated that 83% of them are involved with some type of after-school activity. What is the standard error of this estimate?

$$SE_{\hat{p}} = \sqrt{\frac{(.83)(1-.83)}{100}} = \boxed{.0376}$$

9. A very selective college claims that the mean GPA of its undergraduates is 3.125. A random sample of 64 of their undergraduates indicates a mean of 2.987 with a standard deviation of .305. What is the standard error of the sample mean?

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{.305}{\sqrt{64}} = \boxed{.038125}$$

10. We want to estimate the proportion of students who favor a four-day school week during May and June.
   a) What sample size would be required to create a margin of error of no more than 2% with 90% confidence?

$$1.645\sqrt{\frac{(.5)(.5)}{n}} \leq .02 \qquad \boxed{n \geq 1692}$$

$$1691.27 \leq n$$

   b) Recalculate the sample size required in part (a) using the fact that earlier studies have indicated the proportion of students favoring a four-day week is approximately 85%.

$$1.645\sqrt{\frac{(.85)(.15)}{n}} \leq .02 \qquad \boxed{n \geq 863}$$

$$862.55 \leq n$$

11. Durations of 74 storms in the Tampa Bay area are reported in a 2002 study. The mean is 75.7 min. The population standard deviation is 60.7 min.

   a) How many storms would the study have to include so that your confidence interval had a margin of error of no more than 10 min? Use the 95% confidence level as in part (b).

$$1.96\frac{60.7}{\sqrt{n}} \leq 10 \qquad \boxed{n \geq 142}$$

$$141.54 \leq n$$

   b) Construct and interpret a 95% confidence interval for the mean duration of storms in the Tampa Bay area. Assume the conditions for inference are met.

P: μ = mean duration of all storms in the Tampa Bay area.

A: ✓Random – Problem states that we can assume the conditions are met.
✓Normal – Approximately Normal by the CLT since $n \geq 30$ $(n = 74)$
✓Independent – $n \leq \frac{1}{10}N \rightarrow N \geq 740$ There have been at least 740 storms in Tampa Bay.

N: Since σ is known, we will use a one-sample z interval.

I: $\bar{x} \pm z^* \frac{\sigma}{\sqrt{n}}$

$$75.7 \pm 1.96\left(\frac{60.7}{\sqrt{74}}\right) \rightarrow 75.7 \pm 13.83$$

$$(61.87, 89.53)$$

C: We are 95% confident that the interval from 61.87 min to 89.53 min captures the mean duration of all storms in the Tampa Bay area.

12. A simple random sample of 101 students at Washburn High School is taken. The mean grade point average of the sample (on a 4-point scale) was 3.12 with a standard deviation of 0.35. Construct and interpret a 95% confidence interval for the mean grade point average of all Washburn students.

P: μ = mean GPA of all Washburn students.

A: ✓Random – A simple random sample of 101 students was taken.

✓Normal – Approximately Normal by the CLT since $n \geq 30$ $(n=101)$.

✓Independent – $n \leq \frac{1}{10}N \rightarrow N \geq 1{,}010$ Washburn has more than 1,010 students.

N: Since σ is unknown, we will use a one-sample t interval.

I: $\bar{x} \pm t^* \frac{s}{\sqrt{n}}$

$3.12 \pm 1.984\left(\frac{.35}{\sqrt{101}}\right) \rightarrow 3.12 \pm .0691$

$(3.0509, 3.1891)$ $df = 101 - 1 = 100$

C: We are 95% confident that the interval from 3.0509 to 3.1891 captures the mean GPA of all Washburn students.

13. A newspaper headline proclaimed "Most U.S. Catholics want changes in policies of Catholicism." The article was a report of a Gallup Poll based on random interviews with 264 U.S. Catholics. 150 of those interviewed favor changing the Catholic church's policies. Construct and interpret a 95% confidence interval for the proportion of all U.S. Catholics who want change.

P: p = proportion of all U.S. Catholics who want change.

A: ✓Random – Random interviews were taken.

✓Normal – $n\hat{p} = 264(.5682) = 150 \geq 10$ ✓

$n(1-\hat{p}) = 264(.4318) = 114 \geq 10$ ✓ Approximately Normal

✓Independent – $n \leq \frac{1}{10}N \rightarrow N \geq 2{,}640$ there are at least 2,640 U.S. Catholics.

N: One-proportion z interval

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

$.5682 \pm 1.96\sqrt{\frac{(.5682)(.4318)}{264}} \rightarrow .5682 \pm .0598$

$(.5084, .6280)$

C: We are 95% confident that the interval from 50.84% to 62.80% captures the proportion of all U.S. Catholics who want change.