Paulson

Chapter 8 Test Review

Multiple Choice Questions

1. A USA Today "Lifeline" column reported that in a survey of 500 people, 39% said they watch their bread while it is being toasted. Establish a 90% confidence interval estimate for the percentage of people who watch their bread being toasted.

   $n = 500$ $\quad = .39 \pm 1.645\left(\sqrt{\frac{.39(.61)}{500}}\right)$

   $\hat{p} = .39$ $\quad = .39 \pm .0359$

   $CL = 90\%$

   A) 39% ± .078%
   B) 39% ± 2.2%
   C) 39% ± 2.8%
   D) 39% ± 3.6%
   E) 39% ± 4.3%

2. In a survey funded by Burroughs-Welcome, 750 of 1000 adult Americans said they didn't believe that they could come down with a sexually transmitted disease (STD). Construct a 95% confidence interval estimate of the proportion of adult Americans who don't believe they can contract an STD.

   $n = 750$

   $\hat{p} = \frac{750}{1000} = .75$

   $CL = 95\%$

   1-prop z-interval (.72316, .77684)

   A) (.728, .772)
   B) (.723, .777)
   C) (.718, .782)
   D) (.713, .787)
   E) (.665, .835)

3. A politician wants to know what percentage of the voters support her position on the issue of forced busing for integration. What size voter sample should be obtained to determine with 90% confidence the support level to within 4%?

   $ME = .04$ $\quad 1.645 \cdot \sqrt{\frac{(.5)(.5)}{n}} \leq .04$

   $CL = 90\%$ $\quad \sqrt{\frac{(.5)(.5)}{n}} \leq .024316$

   $z^* = 1.645$

   $\frac{.25}{n} \leq .0005912$

   $422.81 \leq n$

   A) 21
   B) 25
   C) 423
   D) 600
   E) 1691

4. In a test for acid rain, an SRS of 49 water samples showed a mean pH level of 4.4 with a standard deviation of 0.35. Find a 90% confidence interval estimate for the mean pH level.

   $n = 49$ $\quad t^* = 1.677$ $\quad 4.4 \pm 1.677\left(\frac{.35}{\sqrt{49}}\right)$

   $\bar{x} = 4.4$ $\quad df = 48$ $\quad 4.4 \pm .08385$

   $s = .35$

   $CL = 90\%$

   T-interval test
   (4.3161, 4.4839)

   A) 4.4 ± 0.01
   B) 4.4 ± 0.08
   C) 4.4 ± 0.32
   D) 4.4 ± 0.35
   E) 4.4 ± 0.58

5. What sample size should be chosen to find the mean number of absences per month for school children to within ± .2 at a 95% confidence level if it is known that the standard deviation is 1.1?

A) 11
B) 29
C) 82
D) 96
E) 117

ME = .2
CL = 95%
S = 1.1
Z*

$1.96\left(\frac{1.1}{\sqrt{n}}\right) \le .2$

$\frac{1.1}{\sqrt{n}} \le .102041$

$10.78 \le \sqrt{n}$

$116.21 \le n$

6. A random sample of 100 visitors to a popular theme park spent an average of $142 on the trip with a standard deviation of $47.5. Which of the following would the 98% confidence interval for the mean money spent by all visitors to this theme park?

A) ($130.77, $153.23)
B) ($132.57, $151.43)
C) ($132.69, $151.31)
D) ($140.88, $143.12)
E) ($95.45, $188.55)

n = 100
$\bar{x} = 142$
S = 47.5
CL = 98%
df = 99

T- interval test

(130.77, 153.23)

7. How large of a random sample is required to insure that the margin of error is 0.08 when estimating the proportion of college professors that read science fiction novels with 95% confidence?

A) 604
B) 307
C) 151
D) 75
E) 25

ME = .08
CL = 95%
Z* = 1.96

$1.96\sqrt{\frac{(.5)(.5)}{n}} \le .08$

$\sqrt{\frac{.25}{n}} \le .040816$

$\frac{.25}{n} \le .00166597$

$150.06 \le n$

8. A quality control specialist at a plate glass factory must estimate the mean clarity rating of a new batch of glass sheets being produced using a sample of 18 sheets of glass. The actual distribution of this batch is unknown, but preliminary investigations show that a normal approximation is reasonable. The specialist decides to use a t-distribution rather than a z-distribution because

A) The z-distribution is not appropriate because the sample size is too small.
B) The sample size is large compared to the population size.
C) The data comes from only one batch.
D) The variability of the batch is unknown.
E) The t-distribution results in a narrower confidence interval

Remember:
Variability relates to SD

9. A research and development engineer is preparing a report for the board of directors on the battery life of a new cell phone they have produced. At a 95% confidence level, he has found that the battery life is 3.2 ± 1.0 days. He wants to adjust his findings so the margin of error is as small as possible. Which of the following will produce the smallest margin of error?

   A) Increase the confidence level to 100%. This will assure that there is no margin of error.
   B) Increase the confidence level to 99%.
   C) Decrease the confidence level to 90%.
   D) Take a new sample from the population using the exact same sample size.
   E) Take a new sample from the population using a smaller sample size.

The smaller the CL, the smaller the ME.

10. A biologist has taken a random sample of a specific type of fish from a large lake. A 95 percent confidence interval was calculated to be 6.8 ± 1.2 pounds. Which of the following is true?

   A) 95 percent of all the fish in the lake weigh between 5.6 and 8 pounds.
   B) In repeated sampling, 95 percent of the sample proportions will fall within 5.6 and 8 pounds.
   C) In repeated sampling, 95% of the time the true population mean of fish weights will be equal to 6.8 pounds.
   D) In repeated sampling, 95% of the time the true population mean of fish weight will be captured in the constructed interval.
   E) We are 95 percent confident that all the fish weigh less than 8 pounds in this lake.

11. A researcher is interested in determining the mean energy consumption of a new compact florescent light bulb. She takes a random sample of 41 bulbs and determines that the mean consumption is 1.3 watts per hour with a standard deviation of 0.7. When constructing a 97% confidence interval, which would be the most appropriate value of the critical value?

   A) 1.936
   B) 2.072
   C) 2.250
   D) 2.704
   E) 2.807

$n = 41$ t^*

$\bar{x} = 1.3$

$s = .7$

$df = 40$

$\text{InvT}(.015, 40) = 2.250$

Free Response Questions

1. An SRS of 1000 voters finds that 57% believe that competence is more important than character in voting for President of the United States.

   A) Determine and interpret a 95% confidence interval estimate for the percentage of voters who believe competence is more important than Character.

By hand:

$n = 1000$

$\hat{p} = .57$

$CL = 95\%$

$Z^* = 1.96$

$SE_{\hat{p}} = \sqrt{\frac{(.57)(.43)}{1000}} = .0157$

$CI = .57 \pm 1.96(.0157)$

$(.53923, .600772)$

Calculator:

$X = 570$

$n = 1000$

C-Level = .95

$\hat{p} = .57$

*Using my calculator, I performed a 1-proportion Z-interval test.

$(.53932, .60068)$

I am 95% confident that the true population proportion of voters who believe competence is more important than character is between 53.923% and 60.0772%.

Conditions:

(1) As stated, this is an SRS.

(2) $1000 \leq \frac{1}{10} N \rightarrow 10{,}000$. We can assume that there are at least 10000 voters

(3) $1000(.57) \geq 10$ $\quad 1000(.43) \geq 10$

$570 \geq 10$ $\quad 430 \geq 10$

There are at least 10 successes and 10 failures.

2. You want to estimate the mean amount spent by customers at a local gas station with 98% confidence and a margin of error of no more than \$2. Preliminary data suggests that σ = \$5.10 is a reasonable estimate for the standard deviation of customers. How large a sample do you need?

$CL = 98\%$

$ME = 2$

$\sigma = 5.10$

$Z^* = 2.326$

$\frac{2.326\left(\frac{5.10}{\sqrt{n}}\right)}{2.326} \leq \frac{2}{2.326}$

$\sqrt{n} \cdot \frac{5.10}{\sqrt{n}} \leq .859845 \cdot \sqrt{n}$

$\frac{5.10}{.859845} \leq \frac{.859845\sqrt{n}}{.859845}$

$(5.931302)^2 \leq (\sqrt{n})^2$

$35.18 \leq n$

You must survey at least 36 customers.

3. Considerable research is being done in bioremedication – the use of living organisms to clean up pollution. In a recently conducted experiment, researchers used fungi to degrade hydrocarbons, the by-products of incomplete combustion of fossil fuels. The by-products can cause cancer, and their accumulations in water and soil poses an environmental hazard.

In order to be cost-effective, a minimum of 1.00 micromoles/gram of soil of a particular hydrocarbon must be degraded. The researchers added fungi and growth media (essentially sugar) to the soil in 9 containers with random samples of soil and obtained the following degradation rates in micromoles/min/gram:

0.83	0.91	1.00
1.08	1.08	1.09
1.10	1.23	1.36

A) Construct and interpret a 90% confidence interval for the mean degradation rate. Can the researchers be confident that this process will be cost-effective?

by-hand: $n = 9$

$\bar{x} = 1.076$

$S_x = .1577$

$df = 8$

$t^* = 1.860$

$SE_{\bar{x}} = \frac{.1577}{\sqrt{9}} = .0526$

$CI = 1.076 \pm 1.860(.0526)$

$(.978164, 1.173836)$

Calculator

$\bar{x} = 1.076$

$S_x = .1577$

$n = 9$

$CL = .90$

Using my calculator, I performed a T-interval test

$(.97779, 1.1733)$

I am 90% confident that the average mean degradation rate is between .978164 and 1.173836 micromoles/gram. Since some of the interval is below 1.00, we cannot be confident that the degradation rate is greater than 1.00, so the methods may not be cost effective.

Conditions

① As stated, this is an SRS.

② $9 \leq \frac{1}{10}N \rightarrow 90$

We can assume that there are at least 90 soil samples.

③ when the data was graphed, it was appoximately normal and had no outliers.