AP Stats Ch 23 - Extra Practice

Name: Solutions Per: ___

12. Parking. Hoping to lure more shoppers downtown, a city builds a new public parking garage in the central business district. The city plans to pay for the structure through parking fees. During a two-month period (44 weekdays), daily fees collected averaged \$126, with a standard deviation of \$15.

a) What assumptions must you make in order to use these statistics for inference?

b) Write a 90% confidence interval for the mean daily income this parking garage will generate.

c) Explain in context what this confidence interval means.

d) Explain what "90% confidence" means in this context.

e) The consultant who advised the city on this project predicted that parking revenues would average \$130 per day. Based on your confidence interval, do you think the consultant could have been correct? Why?

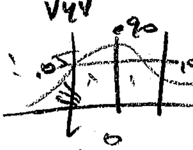
a) Conditions: – SRS (these fee are representative)

– 44 days < 10% of all weekdays

– Nearly Normal (can assume because $n \geq 40$)

b) $CI = \bar{x} \pm t^* SE_{\bar{x}}$ $n=44$, $\bar{x}=126$, $s=15$, $df=44-1=43$

$CI = 126 \pm (1.681)(2.261)$ $SE_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{15}{\sqrt{44}} = 2.261$

$= \boxed{(\$122.20, \$129.80)}$ t^* for 90%: 

$t^* = invT(.05, 43) = \pm 1.681$

c) We are 90% confident that the average daily parking fees collected will be between \$122.20 and \$129.80.

d) If we collected many samples of 44 days fees and found confidence intervals for each, 90% of these confidence intervals would contain the true daily average of parking fees.

e) No, \$130 is outside the confidence interval, so it is unlikely the average will be this high.

14. Parking II. Suppose that for budget planning purposes the city in Exercise 12 needs a better estimate of the mean daily income from parking fees.

a) Someone suggests that the city use its data to create a 95% confidence interval instead of the 90% interval first created. How would this interval be better for the city? (You need not actually create the new interval.)

b) How would the 95% interval be worse for the planners?

c) How could they achieve an interval estimate that would better serve their planning needs?

d) How many days' worth of data must they collect to have 95% confidence of estimating the true mean to within $3?

a) The 95% confidence interval would be wider than the 90% interval. This is better because we are more confident the true daily average value is in this interval...

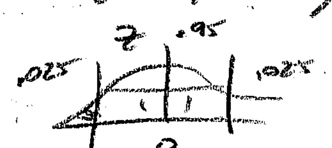
b) ... but it is less precise (wider) than the 90% interval.

c) They could collect a larger sample (more days). This would lower $SE_{\bar{x}}$ and improve precision without giving up confidence.

d) $ME = 3$

$t^* \frac{s}{\sqrt{n}} = 3$

t^* requires invT(Leftarea, df) but df requires knowing n ahead of time. We don't know n, so we use z^* instead.



$z^* = \text{invNorm}(.025, 0, 1) = \pm 1.96$

$$z^* \frac{s}{\sqrt{n}} = 3$$

$$(1.96)\frac{15}{\sqrt{n}} = 3$$

$$\frac{15}{\sqrt{n}} = \frac{3}{1.96}$$

$$3\sqrt{n} = 15(1.96)$$

$$\sqrt{n} = \frac{15(1.96)}{3}$$

always round up

$$n = \left(\frac{15(1.96)}{3}\right)^2 = 96.04 \uparrow = \boxed{97 \text{ days}}$$

25. Marriage. In 1960, census results indicated that the age at which American men first married had a mean of 23.3 years. It is widely suspected that young people today are waiting longer to get married. We want to find out if the mean age of first marriage has increased during the past 40 years.

a) Write appropriate hypotheses.

b) We plan to test our hypothesis by selecting a random sample of 40 men who married for the first time last year. Do you think the necessary assumptions for inference are satisfied? Explain.

c) Describe the approximate sampling distribution model for the mean age in such samples.

d) The men in our sample married at an average age of 24.2 years with a standard deviation of 5.3 years. What's the P-value for this result?

e) Explain (in context) what this P-value means.

f) What's your conclusion?

a) $H_0: \mu = 23.3$ yrs Average age of marriage is 23.3 yrs.

$H_A: \mu > 23.3$ yrs Average age of marriage has increase above 23.3 yrs

b) ✓ — SRS "random sample"

✓ — 40 < 10% of US men

✓ — Nearly Normal: w/ n = 40 can assume even without data

$\boxed{\text{Yes}}$

c) $\mu_{\bar{x}} = \mu_0 = 23.3$ yrs $SE_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{?}{\sqrt{40}}$ will be a t distribution with 39 degrees of freedom, mean at 23.3 yrs and $SE_{\bar{x}} = \frac{s}{40}$.

d) $SE_{\bar{x}} = \frac{5.3}{\sqrt{40}} = .838$ yrs $t = \frac{24.2 - 23.3}{.838} = 1.074$

1.074

p-value = tcdf(1.074, 999, 39) = $\boxed{.1447}$

e) If mean age of marriage is actually 23.3 yrs, there is a .1447 probability of a sample of 40 men having a mean age of marriage as high as 24.2 years (or higher) just due to chance.

f) With $\alpha = .05$, p-value = .1447 is high so we fail to reject H_0. We do not have sufficient statistical evidence to conclude that average age of marriage has increased above 23.3 years.

7. Meal plan. After surveying students at Dartmouth College, a campus organization calculated that a 95% confidence interval for the mean cost of food for one term (of three in the Dartmouth trimester calendar) is ($780, $920). Now the organization is trying to write its report, and considering the following interpretations. Comment on each.

a) 95% of all students pay between $780 and $920 for food.

No, 95% is how confident, not a percentage of students

b) 95% of the sampled students paid between $780 and $920.

"

c) We're 95% sure that students in this sample averaged between $780 and $920 for food.

No we know for certain the sample average (it is the value in the middle)

d) 95% of all samples of students will have average food costs between $780 and $920.

No, 95% isn't a percentage of samples, it's a percentage of confidence intervals.

e) We're 95% sure that the average amount all students pay is between $780 and $920.

this is closest. It correctly uses 95% as a measure of the level of confidence.

Alt preferred wording:

If we took many samples, and computed confidence intervals for each, 95% of those confidence intervals would contain the true population percentage of all students average cost of food (so we are 95% sure that this particular confidence interval contains the true value).