STAT 301 HW9 due Mon Oct 12

You may work with one partner on this assignment, submitting one report with both names, provided that both students contribute substantially to the work. Word-processed reports are preferred to hand-written ones. Please copy/paste relevant computer output into your report as appropriate.

Time Travel?
You may work with one other person on this assignment, submitting one report with both names, provided that both students contribute substantially to the work. Please copy/paste relevant Minitab output into your Word file as appropriate.

We collected data in class about whether you would prefer to travel to the past or the future if time travel were possible.

a) Use the class data on the time travel question to produce a 95% (normal-based, Wald) confidence interval for the proportion of all Cal Poly students who would prefer to travel to the future. (Please do this one by hand.)

In our class 15 students opted for the future and 19 for the past. The sample proportion choosing the future is $\hat{p} = 15/34 \approx .4412$. A 95% CI for the population proportion who would choose the future is: $.4412 \pm 1.96\sqrt{\frac{.4412 \times .5588}{34}}$, which is .4412 ± .1669, which is the interval (.2743, .6081).

b) Write a sentence interpreting what this interval reveals.

We can be 95% confident (if this had been a random sample) that the proportion of all Cal Poly students who opt to travel to the future rather than the past is between .274 and .608.

c) Write a sentence explaining what the phrase "95% confidence" means in this context.

The phrase "95% confidence" stems from knowing that if we were to take many random samples from the population and construct a 95% CI from each sample, then in the long run 95% of those intervals would succeed in capturing the actual value of the population proportion.

d) Produce 90% and 99% confidence intervals for the population proportion. (Feel free to use Minitab.) Comment on how your three intervals compare, in terms of midpoints and half-widths (margins-of-error).

Minitab reveals the 90% CI to be (.301, .581) and the 99% CI to be (.222, .661). (These are the Wald intervals, based on the normal approximation.) All three intervals have the same midpoint, namely the sample proportion .4412. The 90% CI is the narrowest of these three, and the 99% CI is the widest.

e) Did we use a random sample to gather these data? If not, do you have any concerns that our sampling method might have been biased with regard to this issue? Explain.

No, we used our class, which is certainly not a random sample of Cal Poly students. Most of the students in our class are Mathematics or Statistics majors, or other majors with a quantitative emphasis. But with regard to this question of time travel, our class may not be biased in a particular direction.

f) Is the sample size condition for this interval to be valid satisfied?

Yes, because $n\hat{p} = 15$ and $n(1-\hat{p}) = 19$ are both at least 10.

g) Use the adjusted Wald method to produce a 95% confidence interval for the parameter. Comment on how this interval differs from the Wald interval.

With the adjusted Wald procedure, we use $\tilde{p} = (15+2)/(34+4) = 17/38 \approx .4474$. A 95% CI for the population proportion who would choose the future is: $.4474 \pm 1.96\sqrt{\frac{.4474 \times .5526}{38}}$, which is $.4474 \pm .1581$, which is the interval (.2893, .6055). This interval is a bit narrower than the Wald interval, and it has a (very) slightly larger midpoint.

h) Determine how large a sample would be needed to estimate the population proportion to within ±.06 with 95% confidence. (Treat our class result as a pilot study for your calculation.)

Using the Wald procedure, and using an estimate of $\hat{p} \approx .4412$, we want to choose the sample size n such that: $1.96\sqrt{\frac{.4412 \times .5588}{n}} \leq .06$. Solving for n gives: $n \geq (.4412)(.5588)(1.96)^2/(.06)^2 \approx 263.09$, so a sample size of 264 students will be needed.