Directions: Work on these sheets. Answer completely, but be concise.

Part 1: Multiple Choice. *Circle the letter corresponding to the best answer.*

1. Some scientists believe that a new drug would benefit about half of all people with a certain blood disorder. To estimate the proportion of patients who would benefit from taking the drug, the scientists will administer it to a random sample of patients who have the blood disorder. What sample size is needed so that the 95% confidence interval will have a *width* of 0.06?
   (a) 748
   (b) 1,068
   (c) 1,503
   (d) 2,056
   (e) 2,401

2. A random sample of 900 individuals has been selected from a large population. It was found that 180 are regular users of vitamins. Thus, the proportion of the regular users of vitamins in the population is estimated to be 0.20. The standard error of this estimate is approximately:
   (a) 0.1600
   (b) 0.0002
   (c) 0.4000
   (d) 0.0133
   (e) 0.0267

3. 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. Students are interviewed by a reporter "roaming" the campus selecting students to interview "haphazardly." On a particular day the reporter interviews five students 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?
   (a) The data are an SRS from the population of interest.
   (b) The population is at least ten times as large as the sample.
   (c) $n\hat{p} \geq 10$ and $n(1-\hat{p}) \geq 10$.
   (d) We are interested in inference about a proportion.
   (e) More than one condition is violated.

4. A 95% confidence interval for p, the proportion of Canadian beer drinkers who prefer Lion Red was found to be (0.236, 0.282). Which of the following is correct?
   (a) About 95% of beer drinkers have between a 23.6% and a 28.2% chance of drinking Lion Red.
   (b) There is a 95% probability that the sample proportion lies between 0.236 and 0.282.
   (c) If a second sample was taken, there is a 95% chance that its confidence interval would contain 0.25.
   (d) This confidence interval indicates that we would likely reject the hypothesis $H_0: p = 0.25$.
   (e) We are reasonably certain that the true proportion of beer drinkers who prefer Lion Red is between 24% and 28%.

5. Refer to the previous question. Suppose that the same poll was repeated in the United States (whose population is 10 times larger than Canada), but in this new poll, four times the number of people were interviewed. The resulting 95% confidence intervals will be:
(a) about 1/2 as wide as the Canadian interval
(b) about 1/4 as wide as the Canadian interval
(c) about 1/10 as wide as the Canadian interval
(d) about 4/10 times as wide as the Canadian interval
(e) the same size as the Canadian interval

6. In a large Midwestern university (the class of entering freshmen being on the order of 6000 or more students), an SRS of 100 entering freshmen in 1993 found that 20 finished in the bottom third of their high school class. Admission standards at the university were tightened in 1995. In 1997 an SRS of 100 entering freshmen found that 10 finished in the bottom third of their high school class. Let p_1 and p_2 be the proportion of all entering freshmen in 1993 and 1997, respectively, who graduated in the bottom third of their high school class.

What conclusion should we draw?
(a) We are 95% confident that the admissions standards have been tightened.
(b) Reject H_0 at the $\alpha = 0.01$ significance level.
(c) Fail to reject H_0 at the $\alpha = 0.05$ significance level.
(d) There is significant evidence of a decrease in the proportion of freshmen who graduated in the bottom third of their high school class that were admitted by the university.
(e) If we reject H_0 at the $\alpha = .05$ significance level based on these results, we have a 5% chance of being wrong.

7. In a test of $H_0: p = 0.4$ against $H_a: p \neq 0.4$, a sample of size 100 produces $z = 1.28$ for the value of the test statistic. Thus the P-value (or observed level of significance) of the test is approximately equal to:
(a) 0.90
(b) 0.40
(c) 0.05
(d) 0.20
(e) 0.10

Part 2: Free Response
Communicate your thinking clearly and completely.

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."

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

9. Based on the survey results, can the U.S. Park Service conclude that more than half of all Yellowstone visitors are in favor of the added restrictions? Carry out an appropriate test.

When the antihistamine *Seldane* was first introduced, it was heavily promoted because it supposedly didn't cause drowsiness, unlike other antihistamines. A portion of the prescribing information for the drug is taken from an advertisement:

ADVERSE EVENTS REPORTED IN CLINICAL TRIALS		
Percent of Patients Reporting		
Adverse Event	Seldane (N = 781)	Placebo (N = 665)
Drowsiness	9.0	8.1

10. If we let p_1 = the proportion of all people experiencing drowsiness who take Seldane, and let p_2 = the proportion of all people experiencing drowsiness who take the placebo, then determine $\hat{p}_1$ and $\hat{p}_2$. (Caution: $\hat{p}_1$ is not 0.0115!)

11. State appropriate hypotheses in symbols and words for carrying out a significance test.

12. Verify the necessary conditions for performing inference in this setting.

13. Calculate the test statistic and the P-value.

14. What conclusion would you draw? Explain.

Ch 12 Review

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(8) **Step 1:** Let p = the proportion of all visitors to Yellowstone who favor tighter restrictions on vehicle access. **Step 2:** The U.S. Forest Service took a random sample of 150 park visitors, but we do not know if it was an SRS. This may affect our ability to generalize. Certainly the population of park visitors is at least 1500 people. Since the counts of "successes" and "failures" are 89 and 61, respectively, we are safe using the z procedures. **Step 3:** Our 99% CI is (0.490,0.697). **Step 4:** We are 99% confident that the true proportion of Yellowstone visitors who favor added vehicle restrictions is between 0.49 and 0.70. (9) **Step 1:** Our hypotheses are $H_0 : p = 0.50$ vs. $H_a : p > 0.50$. **Step 2:** Since $np_0 = n(1 - p_0) = 75$, we can use normal approximation. **Step 3:** $z = 2.29$; P-value = 0.011. **Step 4:** With such a low P-value, we have strong evidence against H_0. We conclude that more than half of all Yellowstone visitors favor the tighter vehicle restrictions. (10) $\hat{p}_1 = 0.09$ and $\hat{p}_2 = 0.081$. (11) Our hypotheses are $H_0 : p_1 = p_2$ —There is no difference in the proportion of all Seldane users and placebo users who get drowsy – and $H_a : p_1 \neq p_2$ -- there is a difference. (12) We need to assume that the Seldane and placebo were randomly allocated to the subjects. Our pooled proportion of drowsy subjects is $\hat{p} = 0.0858$. Both $n\hat{p}$ and $n(1 - \hat{p})$ are considerably larger than 10. (13) Our test statistic is $z =$ ‘0.57 and the P-value is 0.568. (14) There is little evidence that the proportion of Seldane users who experience drowsiness differs from the proportion of placebo users who experience drowsiness. (Note: It may seem strange logic when the drug company wants the inference test to "fail", but this approach is not uncommon in the pharmaceutical business.