AP STATISTICS Name: _____ Block: _____

Review Unit VII - Inference with Proportions

_____ 1. We test the hypothesis that $p = 0.77$ versus $p > 0.77$. We are not aware that actually $p = 0.83$. The power of the test is largest when

A) $\alpha = 0.10$, $n = 330$ B) $\alpha = 0.10$, $n = 480$ C) $\alpha = 0.05$, $n = 330$ D) $\alpha = 0.05$, $n = 480$

_____ 2. We test the hypothesis Ho: $p = 0.73$ versus Ha: $p < 0.73$. Assume that the alternative hypothesis is true, and that we keep both the sample size and significance level fixed. The power of the test is largest if the actual population proportion is which of the following?

A) 0.70 B) 0.72 C) 0.75 D) 0.78 E) 0.80

3. In a study of air-bag effectiveness, a recent survey found that in 821 crashes of midsize cars equipped with air bags, 46 of the crashes resulted in hospitalization of the drivers.

a) Create and interpret a 90% confidence interval to estimate the true air-bag hospitalization rate.

b) Interpret the 90% confidence **level** in context.

4. A pharmaceutical company is testing a new drug to treat a potentially fatal disease. The current treatment is effective on 32% of patients. The cost of the research is quite expensive for the company, and research on the newer version will only be allowed to continue if tests show that the effectiveness for the newer version is significantly higher than the current 32%. A clinical study is planned to test the newer treatment.

   a) Describe both a type I and type II error in context, along with a possible consequence of each.

   b) In a randomized experiment, 43 patients with the disease were given the newer version of the drug, and the treatment was effective on 18 of them (this is almost 42%). Perform a test of significance to see if the newer version of the drug is more effective than the current treatment.

c) The p-value that you **should** have obtained in part (b) is 0.0829. Interpret the meaning of this p-value in context.

d) Biomedical research suggests that this new treatment should be effective on 45% of patients. Assuming this is true, what type of error was probably committed based on the results of the test conducted in part (b)?

e) Against this alternative, the probability of a type II error for the hypothesis test in part (a) is 0.432. What is the power of this hypothesis test? Interpret this value in context.

f) What are two ways to increase the power of this hypothesis test?

5. An automobile manufacturer tries two distinct assembly procedures. In a random sample of 850 cars coming off the line, 350 were randomly assigned to the first procedure with 28 major defects, while 500 autos were randomly assigned to the second line with 32 major defects.

   a) Is there a difference in the defect rate between the two procedures at the 5% significance level.

b) Explain the meaning of the p-value that was calculated in part (a).

6. A study of small-business failures looked at a random selection of 148 food-and-drink businesses in Texas. Of these, men headed 106 and 42 were headed by women. During a three-year period, 15 of the men's businesses and 11 of the women's businesses failed.

   a) Estimate the difference between the proportions at which businesses headed by men and women fail using a 90% confidence interval.

   b) Does this interval provide evidence that food-and-drink businesses in Texas that are headed by women are more likely to fail than those headed by men? Explain.

7. Hannah performs the calculations for a hypothesis test and obtains a z-statistic of -2.04. Unfortunately, Hannah's lab partner, Jeanette, lost their lab papers, and Hannah cannot remember what their hypotheses were.

   a) If Hannah was performing a two-sided test, what would their p-value be?

   b) If Hannah was performing a one-sided test, what are the possible p-values for their test? (THERE IS MORE THAN ONE!)

8. **ALPHA REVISITED** A biomedical engineer named Masha is testing a new treatment to fight a horrible seasonal disease called "senioritis". After conducting a 6-week long clinical trial, her team of researchers finds that the new treatment is NOT significantly better than the currently available treatment when testing at the 5% level of significance. Thus, she decides to stop development on the new anti-senioritis treatment.

   a) Was the p-value of the hypothesis test greater than or less than 5%? Explain.

   b) Would the researchers have come to the same conclusion (that the new treatment is NOT better than the current treatment) if testing at a 1% (one percent) level of significance? Explain.

   c) Would they have come to the same conclusion if testing against a 10% (ten percent) level of significance? Explain.

   Now suppose that after another 8 months of research and development, Masha and her team conduct another study using a new formula for their anti-senioritis treatment. This time, the researchers find that the new formula IS significantly more effective than the current treatment at fighting senioritis when testing at the 5% level of significance.

   d) Would the researchers have come to the same conclusion (that the new treatment is now more effective than the current treatment) if testing at the 1% level of significance? What if they were testing at the 10% level of significance?

9. A local news organization wishes to estimate the proportion of all Austin households that have experienced some sort of crime by constructing a 95% confidence interval based on survey data.

a) In the context of this situation, interpret the 95% confidence level. *(interpret the LEVEL!)*

b) In a random sample of 300 Austin households, 68 report that they had experienced some sort of crime. Construct and interpret a 95 confidence interval to estimate the proportion of Austin households that have experienced some sort of crime.

c) The Gallup Organization conducted a national study on crime victimizations and reports that 25% of all households experience some sort of crime. Based on this interval, is there evidence to suggest that the proportion of Austin households who experienced some sort of crime is less than the national proportion?

d) Suppose that another media organization wishes to conduct a similar survey in Austin. What is the minimum number of households that they would need to survey in order to guarantee a margin of error of no more than ±2% with a confidence level of 93%?

AP Statistics
Unit VII Review – Inference with Proportions

****ANSWERS ONLY**** *(for explanations, please come in for tutorials)*

1. B
2. A

3. a) 1-proportion z-interval: (0.0428, 0.0692) *[be sure to ALWAYS interpret the interval!]*
   b) If we took repeated random samples using this method, about 90% of the resulting confidence intervals would contain the true proportion of accidents that result in the hospitalization of the driver.
4. a) Type I Error:
   We decide that the new drug IS more effective than the current treatment, when in reality, it is NOT. A possible consequence is that the company continues investing (**WASTING**?) money on a treatment that is no more effective than the current treatment.
   Type II Error: ???

   b) 1-proportion z-test: z = 1.3861, p-value = 0.0829
   c) IF the treatment is truly 32% effective, then this is the probability of it being effecting on at least 18 of a random sample of 43 patients.
   d) This would be a type II error (incorrectly failing to reject the H0).
   e) 0.568 – this is the probability of correctly concluding that the new treatment is more effective than the old.
   f) Increase the sample size, or raise the level of significance (increasing the "effect size" is a third).

5. a) 2-proportion z-test: z = 0.8963, p-value = 0.3701
   b) If the two assembly procedures were truly equal in terms of defect rates, then there is roughly a 37% probability of observing a difference this large as a result of the random assignment.

6. a) 2-proportion z-interval: (-0.2451, 0.0043)
   b) No. Since zero is contained in this interval, we lack evidence of a difference in the failure rates…

7. a) 0.0414
   b) Either 0.0207 or 0.9793

8. a) ??? (sorry, you'll need to think about this one)
   b) Yes
   c) We don't know. . .
   d) ???

9. a) In a large number of repeated random samples, roughly 95% of the resulting intervals would contain the true proportion of households in Austin that have experienced some sort of crime.
   b) 1-proportion z-interval: (0.179, 0.275)
   c) No, as the interval is not completely below 0.25.
   d) 2048 households (if you use $z^* = 1.81$ and $p = 0.5$… if you use $p = 0.23$, then you get $n = 1451$)