STA 212: ASSIGNMENT #5

Brief General Instructions (See Assignment #1)

If you have ANY questions about the homework at ANY time, please stop by the office and I will assist you. If it is more convenient, many questions can also be answered by email (nolanj1@nku.edu).

Homework for Module #5

Problems from 1-5 will be used for in-class examples. The remainder will be assigned as homework.

1. A coin that is supposed to be fair is tossed 5000 times and results in 2529 heads. Conduct a hypothesis test to determine whether this coin is, in fact, fair. ***Make sure to show ALL steps of the test (every time you do ANY test).***

2. The U.S. government wishes to identify areas in which expenditures may help reduce driving-related fatalities. A fund is established to grant substantial funding for education regarding factors that are involved in at least 25% of fatalities. In a national survey of traffic accidents over a 1 month period of time, 3928 fatalities were recorded. Of these, 1218 involved alcohol.

    a. Conduct a hypothesis test to determine whether funding should be allocated to education about drunk driving. ***Make sure to show ALL steps!***

    b. Use an appropriate confidence interval to estimate the actual percentage of driving-related fatalities that are due to alcohol.

    c. If we wanted to estimate this percentage within $\pm 1.00\%$, what sample size would be necessary?

3. An upgrade to equipment sold by your company will cost customers an additional charge of $500. You contact a random sample of 120 customers who have purchased the equipment and find that 47 of them would be willing to pay for this upgrade. You also know that there is an up-front yearly cost of $4000 for the upgrade, and then your company makes profit of $25 per upgrade sold. Finally, you know that on average, you sell about 800 pieces of the original equipment each year.

    a. What percentage of the 800 who buy the original would need to buy the upgrade in order for you to break even?

    b. Conduct a hypothesis test to determine whether or not you should produce the upgrade. ***Make sure to show ALL steps!***

    c. Produce an appropriate confidence interval to estimate the proportion of your customers who would be willing to purchase the upgrade.

    d. Transform this CI in such a way as to estimate the amount of profit you will make by producing the upgrade.

4. In a random sample of 48 students at NKU we find that 3 who are married. Conduct a hypothesis test to determine if less than 10% of the student population at NKU are married. If we wanted to estimate this percentage within $\pm 3.00\%$, what sample size would be necessary?

5. A producer of frozen orange juice claims that 20% or more of all orange juice drinkers prefer its product. A competitor would like to show that this figure is too large. In order to accomplish this, they obtain a sample of 200 orange juice drinkers and find 34 who prefer the producer's brand.

   a. Conduct a hypothesis test to determine whether there is sufficient evidence to disprove this claim. *Make sure to show ALL steps!*
   b. Based on your test in (a), do you believe original claim? What would you do if you wanted to (i) show that there was no practical difference or (ii) continue trying to disprove the claim?
   c. Suppose that they obtain a sample that does show the claim to be false. You later find out that the sample was a convenience sample, and the participants were all from the county that hosts this competitor's productions facilities. What should you conclude now?

6. A supplemental health insurance option for employees at a certain company is currently used by only 15% of employees. A new option is being considered by HR, and 70 employees are surveyed at random to determine if they would enroll in the new coverage. Of these, 59 stated they would not enroll.

   a. Identify an appropriate set of hypotheses that would allow you to determine if the new coverage would increase enrollment.

   b. Explain Type I and Type II errors in the context of this problem, assess their importance, and determine a significance level α.

   c. Determine the statistic that you should calculate to perform your test, the distribution of that statistic, and whether or not your validity conditions are satisfied.

   d. State a decision rule.

   e. Use the data to compute a test-statistic and p-value.

   f. Based on your decision rule and computations, what is the most appropriate conclusion you can draw for this problem?

7. A financial planner claims that only 60% of American adults have some form of saving account. A local bank manager believes that this number is actually greater in his community, so he collects a sample of 55 members of his community and finds 38 of them have a savings account. Conduct a hypothesis test to determine if the manager has proven his point. *Make sure to show all steps!!!*

8. Failure to meet payments on student loans guaranteed by the government has been a major problem for both banks and the government. The percentage of such loans that are in default varies from year to year but is often around 50%. Virginia has adopted a campaign to educate students about their loans in an effort to decrease the default rate. After a year of this campaign, they take a sample of 350 college students having student loans and find that 147 of these are in default. Conduct a hypothesis test to determine if Virginia has been successful in their campaign. *Make sure to show all steps!*

9. Consider Problem #6.

   a. Obtain a confidence interval for the percentage of employees who would enroll in the new coverage. Select the percentage of confidence based on the alpha-value you chose for the test in #6.

   b. Explain how your CI could be used to make the same "decision" as your hypothesis test.

   c. Explain how your CI provides more information than the hypothesis test; Draw the most appropriate conclusions you can based on the CI.

   d. How large would the sample size need to be in order to reduce the margin of error to ± 0.02?

10. Consider Problem #7.

   a. Obtain a confidence interval for the percentage of community members who have a savings account. Select the percentage of confidence based on the alpha-value you chose for the test in #7.

   b. Explain how your CI could be used to make the same "decision" as your hypothesis test.

   c. Explain how your CI provides more information than the hypothesis test; Draw the most appropriate conclusions you can based on the CI.

   d. What sample size would be necessary to prove H_a if in fact the observed value of p is very close to the actual value of π?

11. Consider Problem #8.

   a. Obtain a confidence interval for the percentage of student loans in Virginia that are in default. Select the percentage of confidence based on the alpha-value you chose for the test in #8.

   b. Explain how your CI could be used to make the same "decision" as your hypothesis test.

   c. Explain how your CI provides more information than the hypothesis test; Draw the most appropriate conclusions you can based on the CI.

12. Explain why it is incorrect to state that a confidence interval that is obtained from your data will contain the true population proportion 95% of the time.

For additional practice you might do a selection of problems from 12.81 to 12.87 and another selection of problems from 12.91 to 12.102 (pages 432-434). Note for the latter group you will need to use a computer to get the proportions.

Datasets: You should be able to get the datasets from: http://websites.swlearning.com/cgi-wadsworth/course_products_wp.pl?fid=M20b&flag=student&product_isbn_issn=9780538477499&disciplinenumber=1008&template=AUS. If you have problems, please email me and I'll see what other alternatives I can provide.

Disclosure: A few of these problems have been adapted from *Business Statistics* by Dietrich, Miller, and Snodgrass.