Homework 3 (2/16/05)
DUE: Fri, Feb. 25, beginning of class

In order to complete this week’s homework, you will need to make use of all of the concepts we have covered thus far in class: chi-square tests of goodness of fit and of independence, probability and probability distributions, descriptive statistics, one-sample tests and confidence intervals, two-sample tests and confidence intervals. In addition, this assignment includes some practice on the new concepts of effect size, power, and required sample size. The homework problems to be turned in next week are listed on this page (front and back), while the following pages contain practice problems to do with your study groups. Doing more of the practice problems will further familiarize you with the necessary procedures and help you study for upcoming quizzes. These practice problems cover the new material that we’ve discussed, but I would also encourage you to go back to do the required sample size problems included in previous practice problem sets.

DO PROBLEM SET A IN MS EXCEL AND SPSS. SHOW ALL OF YOUR WORK IN YOUR SPSS OUTPUT.

Note 1: You should save all of your data files and output files in your individual COLLAB course folder. Remember that you cannot access your files once you put them in the hand-in folder, so don’t put them there until you are done with your homework.

Note 2: For hypothesis tests, indicate (either on the SPSS output or on a separate page) the null and alternative hypotheses, the distribution of the sample statistic, the calculated statistic (e.g., $t$) and whether you accept or reject the null.

A. John wants to know more about the relationship between happiness, health, and time of year. He asks a random sample of 50 people to fill out a survey in the winter. The survey contains questions about overall health (e.g., how are you feeling today, how many days were you sick in the last year) and questions about current mood (e.g., are you happy with your job, do you often feel depressed). Based on this survey, he compiles two scores for each person, one representing their health and one representing their mood. This is the same data as HW2 and is available in the COLLAB Course Materials folder in an Excel spreadsheet. John then waits 6 months and collects happiness and health scores again in the summer. This data is also available in the COLLAB folder.

1. **Enter** the data into SPSS, as in Homework 2. Be sure to label your variables appropriately. (10)

2. **Convert** both happiness variables from a quantitative variables into qualitative variables with two categories (low vs. high happiness). (10)

3. **Test** the hypothesis that people with low and high levels of happiness have different levels of health in the winter. (40)

4. **Test** the hypothesis that people with low and high levels of happiness have different levels of health in the summer. (40)

5. **Test** the hypothesis that people have different levels of health in the summer and in the winter. (40)

6. **Summarize** your findings as if reporting it in a journal article. (30)

DO PROBLEM SETS B – D BY HAND. **SHOW ALL OF YOUR WORK.**

B. Using your results from part A, conduct the following effect size and power analyses.

7. **Calculate** the estimated effect size for the test you conducted in #3. (10)

8. **Calculate** the power of this test. (Do this the long way, without using the power tables.) (30)

9. **Calculate** the minimum number of people John would need to survey to get a significant result if he wanted to do this study again. (Again, do this the long way, without using the power tables.) (30)
10. **Calculate** the estimated effect size for the test you conducted in #5. (10)

11. Calculate the power of this test. (Using the power tables.) (15)

12. Calculate the minimum number of people John would need to survey to get a significant result if he wanted to do this study again. (Again, using the power tables.) (15)

C. Do the following problems from Aron & Aron, using the power tables:

- Chapter 9, Set 2: 21a & b, 22a, b & g, 23
- Chapter 10, Set 2: 17, 18c, 19, 20

D. You are a statistics consultant, and a well-paying client wants to conduct a study of cell phones and car accidents. Your client plans on collecting the following data from N people: (a) whether they own a cell phone or not and (b) whether they have been in a car accident or not. Based on previous research, your client believes that about half of the people he surveys will own cell phones. Of the people who own cell phones, 60% will have been in accidents. Of the people who don’t own cell phones, 45% will have been in accidents.

13. **Calculate** the joint probabilities for the four different categories of people (i.e., cell phone owner and car accident, cell phone owner and no car accident, not a cell phone owner and car accident, and not a cell phone owner and no car accident) that your client anticipates observing. Create a contingency table and include the probabilities of owning a cell phone, not owning a cell phone, having an accident, and not having an accident in the margins of the table. (25)

14. Based on the marginal probabilities, **calculate** the probabilities for each of the four categories of people that you would expect if the two variables are independent of one another. (15)

15. **Calculate** the minimum number of people your client should survey to find a significant result. (Use a power level of 50%.) (30)

16. Your client also wants to create a confidence interval for the proportion of people who own cell phones that have been in an accident (the P(accident | cell phone)). **Calculate** the minimum number of people that your client should survey to have a margin of error of 2%. (30)

**Practice Problems**

In addition to these problems, I suggest that you go back through old practice problem sets and do the sample size problems that you were previously unable to solve. You can also go back to practice problem set questions involving hypothesis testing and calculate the effect size (for z-tests and t-tests), the power for each test, and the minimum sample size for the test, either by the long method or by using the power tables.

If you would like additional practice with effect size and power calculations, please consider doing any of the following problems from Aron & Aron:

- Chapter 8: any problems
- Chapter 9: 7-9, 21-23
- Chapter 10: 7-9, 18-20