Homework 5 (Due on March 6)

February 27, 2014 STA 5172

Problem I

A medical practice wants to compare the prevalence of side effects in its patients who take a specific antihypertensive drug with published side-effect rates from the literature. The doctors feel that side-effect rates greater than 20% will not be acceptable to patients. As a test of whether a new drug should be adopted by their practice, they conduct a pilot study among 10 patients in their practice who get the drug. If at least 4 have side effects, then the doctors are reluctant to adopt the drug in their practice. Otherwise, they feel the side-effect prevalence is reasonable and they are willing to use the drug in their practice.

1. If the assessment of this pilot-study experience is represented in a one-sided hypothesis-testing framework where $H_0 : p = 0.2 \, vs. \, H_1 : p > 0.2$, then what is the type I error of the test? (Hint: Use exact binomial probabilities in R).
2. Suppose the actual true prevalence of side effects with the new drug is 50%. What is the power of the test procedure described? (Hint: Use exact binomial probabilities in R).
3. The use of 10 participants in the pilot study is arbitrary. How many participants should be enrolled to achieve a power of 99% in the previous problem? (Hint: Use the normal approximation to the binomial distribution.)

Problem II

Iron-deficiency anemia is an important nutritional health problem in the United States. A dietary assessment was performed on 51 boys 9 to 11 years of age whose families were below the poverty level. The mean daily iron intake among these boys was found to be 12.50 mg with standard deviation 4.75 mg. Suppose the mean daily iron intake among a large population of 9 to 11-year-old boys from all income strata is 14.44 mg. We want to test whether the mean iron intake among the low-income group is different from that of the general population.

1. State the hypotheses that we can use to consider this question.
2. Carry out the hypothesis test in part 1. using the critical-value method with an α level of .05, and summarize your findings.
3. What is the p-value for the test conducted in part 2?

4. The standard deviation of daily iron intake in the larger population of 9 to 11-year-old boys was 5.56 mg. We want to test whether the standard deviation from the low-income group is comparable to that of the general population. State the hypotheses that we can use to answer this question.

5. Carry out the test in part 4. with an α level of 0.05, and summarize your findings.

6. What is the p-value for the test conducted in part 5?

7. Compute a 95% CI for the underlying variance of daily iron intake in the low-income group. What can you infer from this CI?

Problem III

One method for assessing the bioavailability of a drug is to note its concentration in blood and/or urine samples at certain periods of time after the drug is given. Suppose we want to compare the concentrations of two types of aspirin (types A and B) in urine specimens taken from the same person 1 hour after he or she has taken the drug. Hence, a specific dosage of either type A or type B aspirin is given at one time and the 1-hour urine concentration is measured. One week later, after the first aspirin has presumably been cleared from the system, the same dosage of the other aspirin is given to the same person and the 1-hour urine concentration is noted. Because the order of giving the drugs may affect the results, a table of random numbers is used to decide which of the two types of aspirin to give first. This experiment is performed on 10 people; the results are given in Table 8.15. Suppose we want to test the hypothesis that the mean concentrations of the two drugs are the same in urine specimens.

1. What are the appropriate hypotheses?

2. What are the appropriate procedures to test these hypotheses?

3. Conduct the tests mentioned in part (ii).

4. What is the best point estimate of the mean difference in concentrations between the two drugs?

5. What is a 95% CI for the mean difference?

6. Suppose an α level of 0.05 is used for the test in part 3. What is the relationship between the decision reached with the test procedure in part 2. and the nature of the CI in part 5. ?

Table 8.15 Concentration of aspirin in urine samples

Person	Aspirin A 1-hour concentration (mg%)	Aspirin B 1-hour concentration (mg%)
1	15	13
2	26	20
3	13	10
4	28	21
5	17	17
6	20	22
7	7	5
8	36	30
9	12	7
10	18	11
Mean	19.20	15.60
sd	8.63	7.78

Problem IV

A 1980 study was conducted whose purpose was to compare the indoor air quality in offices where smoking was permitted with that in offices where smoking was not permitted. Measurements were made of carbon monoxide (CO) at 1:20 p.m. in 40 work areas where smoking was permitted and in 40 work areas where smoking was not permitted. Where smoking was permitted, the mean CO level was 11.6 parts per million (ppm) and the standard deviation CO was 7.3 ppm. Where smoking was not permitted, the mean CO was 6.9 ppm and the standard deviation CO was 2.7 ppm.

1. Test for whether the standard deviation of CO is significantly different in the two types of working environments.

2. Test for whether or not the mean CO is significantly different in the two types of working environments.

3. Provide a 95% CI for the difference in mean CO between the smoking and nonsmoking working environments.