

HOMEWORK 7

STAT 201-502

Lecture 11, 12, & 13 Material

1. Studies that compare treatments for chronic medical conditions such as headaches can use the same subjects for each treatment. With a crossover design, each person crosses over from using one treatment to another during the study. One such study considered a drug (a pill called Sumatriptan) for treating migraine headaches in children (ML Hamalainen et al, *Neurology*, 48, 1997). The study observed each of 30 children at two times when he/she had a migraine headache. The child received the drug at one time and a placebo at the other time. The order of treatment was randomized and the study was double-blind. For each child, the response was whether the drug or the placebo provided better pain relief. Let p denote the proportion of children having better pain relief with the drug, in the population of children who suffer periodically from migraine headaches. Can you conclude that $p > 0.50$, with more than half of the population getting better with pain relief with the drug, or that $p < .50$, with less than half getting better pain relief with the drug (ie, the placebo being better)? Of the 30 children, 22 had more pain relief with the drug and 8 had more pain relief with the placebo.

(a) For testing $H_o : p = 0.50$ VS $H_a : p \neq 0.50$, show that the test statistic $Z = 2.56$.

(b) Show that the P-value is 0.0104. Interpret.

(c) Check the assumptions needed for this test and discuss the limitations due to using a convenience sample.

2. According to an exit poll in the 2000 New York senatorial election, 55.7% of the sample of size 2232 reported voting for Hillary Clinton. Is this enough evidence to predict who own? Test that the population proportion who voted for Clinton was 0.50 against the alternative that it differed from 0.50. Answer by

(a) Identifying the variable and parameter, and defining the notation.

(b) Stating the hypotheses and checking assumptions for a large-sample test.

(c) Finding the test statistic for the test.

(d) Reporting the P-value and interpreting it.

(e) Explaining how to make a decision for the significance level of 0.05.

3. A study has a random sample of 20 subjects. The test statistic for testing $H_o : \mu = 100$ is $Z = 2.41$. Find the approximate P-value for the alternative

(a) $H_a : \mu \neq 100$

(b) $H_a : \mu > 100$

(c) $H_a : \mu < 100$

4. Do women tend to spend more time on housework than men? If so, how much more? Based on data from the National Survey of Families and Households, one study (Souch and Spitze, *American Sociological Review*, 59, 1994) reported the results in the table for the number of hours spend in housework perweek.

Gender	Sample Size	Mean	Standard Deviation
Women	6764	32.6	18.2
Men	4252	18.1	12.9

- (a) Show that this study estimated that, on the average, women spend 14.5 more hours a week on housework than men.
- (b) Find the standard deviation for comparing the means. What factor causes the standard deviation to be small compared to the sample standard deviations from the two groups?

5. A crossover study of 13 children suffering from asthma (*Clinical and Experimental Allergy*, 20, 1990) compared single inhaled doses of formoterol(F) and salbutamol(S). The outcome measured was the child's peak expiratory flow(PEF) eight hours following treatment. The data on PEF follow:

Child	F	S	Child	F	S	Child	F	S
1	310	270	6	370	300	10	250	210
2	385	370	7	410	390	11	380	350
3	400	310	8	320	290	12	340	260
4	310	260	9	330	365	13	220	90
5	410	380						

Let μ denote the population mean of the difference between the PEF values for the F and S treatments. The variance of the difference is 44.65.

- (a) Calculate the 13 differences between the two scores.
- (b) Carry out the five steps of the significance test for a mean of the difference scores using $H_o : \mu = 0$ VS $H_a : \mu \neq 0$

6. Chelation is an alternative therapy for heart disease that uses repeated intravenous administration of human-made amino acid in combination with oral vitamins and minerals. Practitioners believe it removes calcium deposits from buildup in arteries. However, the evidence for a positive effect is anecdotal or comes from nonrandomized, uncontrolled studies. A double blind random clinical trial comparing chelation to placebo used a treadmill test in which the response was the length of time until a subject experienced ischaemia (lack of blood flow and oxygen to the heart muscles).

(a) After 27 weeks of treatment, the sample mean time for the chelation group was 652 seconds. A 95% confidence interval for the population mean for chelation minus the population mean for placebo was -53 to 36 seconds. Explain how to interpret the confidence interval.

(b) A significance test comparing the means had $P\text{-value} = 0.69$. Specify the hypotheses for this test, which is two-sided.

(c) The authors concluded from the test that, “There is no evidence to support a beneficial effect of chelation therapy.” Explain how this conclusion agrees with inference based on the values in the confidence interval.

7. Do textbook problems 6.40(p418), 6.42(p419), 6.55(p421), 6.56(p421) and 8.22(p553)