Math 1431
Spring 2003 –Test #4 – Answers

Name_____

You are allowed to use your calculator. Explain all answers – answers with no explanation will receive only partial credit. Use complete sentences. Show how you used the calculator to answer the questions below. For each question, note which test on TI83 you used to find the answer. Show all steps for hypothesis tests!

---

1. (10 points) A random sample of 415 potential voters was interviewed 3 weeks before the start of a state-wide campaign for governor; 223 said they favored the new candidate over the incumbent. However, the new candidate made several unfortunate remarks one week before the election. Subsequently, a new random sample of 630 potential voters showed that 307 voters favored the new candidate.

a. Give a 90% CI for the difference in the proportions of the voters who favored the new candidate.
ANS: Use 2-PropZInt on the TI83. The 90% CI for the difference in the proportions of the voters who favored the new candidate is –0.0019 to 0.10195.

b. Do these data support the conclusion that there was a decrease in voter support for the new candidate after the unfortunate remarks were made?
ANS: The hypotheses are H_0: $p_1 = p_2$ and H_a: $p_1 > p_2$. Use 2-PropZTest on the TI83. The p-value is 0.05666, thus we fail to reject H_0 at $\alpha = 0.05$. There is not enough data to accept H_0.

---

2. (20 points) One part of an IQ test for young children involves building a shape with blocks. In a matched pair design, the children were given the same part of the test twice (one month apart). The data is shown below.

1st trial	30	19	19	23	29	78	42	20	12	39
2nd trial	30	6	14	8	14	52	14	22	17	8

a. Is there evidence that there is a difference in the means of the test results?
ANS: In a matched pair design, the hypotheses are H_0: $m = 0$ and H_a: $m \neq 0$. Place 1st trial into list, L_1 and the 2nd trial into list, L_2. Use TTest on list, L_3 (the differences of L_1 and L_2), on the TI83. The p-value is 0.013. Since the p-value $\leq \alpha/2$, we reject H_0 at $\alpha = 0.05$. Thus, there is a difference in the test results.

b. Find the 99% CI for the data.
ANS: Use TInterval on the TI83. The 99% CI for the difference in the means of the test results is –0.3132 to 25.513.

---

3. (20 points) A study was done to determine the effectiveness of varying amounts of vitamin C in reducing the number of common colds. A survey of 450 people provided the following information (expected values in parentheses):

	Daily amount of vitamin C taken			**Totals**
	None	**500 mg**	**1000 mg**	
No colds	57 (62.22)	26 (24.44)	17 (13.33)	100
At least one cold	223 (217.78)	84 (85.56)	43 (46.67)	350
Totals	280	110	60	450

Is there evidence of a relationship between catching a cold and daily amount of vitamin C?

ANS: The hypotheses are H_0: $p_1 = p_2 = p_3$ and H_a: *all the proportions are not the same*. Use χ^2-Test on the TI83. The p-value is 0.3702, we fail to reject H_0 at $\alpha = 0.05$. There is not enough data to accept H_0.

4. (10 points) The English mathematician John Kerrich tossed a coin 10,000 times and obtained 5067 heads.

a. Is this significant evidence at the 10% level that the coin is not balanced?
ANS: The hypotheses are H_0: $p = 0.5$ (because balanced coins will be heads approximately 1/2 of the time – in the long run) and H_a: p_1 0.5. Use 1-PropZTest on the TI83. The p-value is 0.18024, thus we fail to reject H_0 at $\alpha = 0.10$. There is not enough data to accept H_0.

b. Find a 90% confidence interval for the probability (i.e., proportion) that Kerrich's coin comes up heads.
ANS: Use 1-PropZInt on the TI83. The 90% CI for the proportion of the heads is 0.49848 to 0.51492.

---

5. (20 points) How quickly synthetic fibers such as polyester decay in landfills? A researcher buried polyester strips in the soil for different lengths of time, then dug up the strips and measured the force required to break them. Breaking strength is easy to measure and is a good measure of decay. Lower strength means the fabric has decayed. Ten strips were buried. Five strips chosen randomly were dug up after two weeks and the rest were dug up after 16 weeks. Here are the breaking strengths in pounds:

2 weeks	118	126	126	120	129
16 weeks	124	98	110	140	110

Is there good evidence that polyester decays more in 16 weeks than in two weeks?

ANS: Note that "decays more" means "lower strength". The hypotheses are H_0: $m_1 = m_2$ and H_a: $m_1 > m_2$. Use 2-SampTTest on the TI83. The p-value is 0.1857, thus we fail to reject H_0 at $\alpha = 0.05$. There is not enough data to accept H_0.

SHORT ANSWERS:
6. (5 points) Show how to find the expected value for any one of the cells in problem #3.
ANS: For cell 1,1: Expected value = (row 1 total)(col 1 total)/(table total) = (100)(280)/(450) = 62.22.

7. (5 points) What is the meaning of a 95% confidence interval?
ANS: 95% of CI from all samples of size n contain the parameter.

8. (5 points) List the assumptions for either the t-test OR the z-test.
ANS:
For t-test assumptions,
1. data is from an SRS of size n from the population
2. the population is N(ì , ó) but ó is unknown

For z-test assumptions,
1. data is from an SRS of size n from the population
2. the population is N(ì , ó)
3. the sampling distribution is N(ì , (ó/n))

9. (5 points) What is the number of degrees of freedom (df) for either the t-test OR χ^2-test.
ANS: The df for t-test is $n - 1$, where n is the sample size. The df for χ^2-test is $(r - 1)(c - 1)$, where r is the number of rows in the 2×2 table and c is the number of columns.

EXTRA CREDIT:
10. (3 points): What is the formula for the chi-square statistic?

ANS: $$c^2 = \sum_{cells} \frac{(\text{observed counts} - \text{expected counts})^2}{\text{expeceted counts}}$$