Math 1431
Summer 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. (20 points) Two randomly selected bags of m&ms had the following contents:

	Red	Blue	Green	Brown	Yellow	Orange
Bag 1	21	4	6	14	4	8
Bag 2	15	7	12	15	4	5

a. Is there enough evidence that Bag 2 has a significantly higher proportion of green m&ms than Bag 1 at the 10% significance level?

ANS:
H_0: $p_1 = p_2$
H_a: $p_1 < p_2$
$\alpha = 0.10$
Use 2-PropZTest on the TI83. x1 = 6, n1 = 57, x2 = 12, n2 = 58. The p-value is 0.0668. Since p-value $\leq \alpha$, we reject H_0 and accept H_a. In other words, there is enough evidence that Bag 2 has a significantly higher proportion of green m&ms than Bag 1 at the 10% signific ance level.

b. Is there enough evidence that Bag 2 has a significantly different proportion of green m&ms than Bag 1 at the 10% significance level?

ANS:
H_0: $p_1 = p_2$
H_a: $p_1 \ne p_2$
$\alpha = 0.10$
Use 2-PropZTest on the TI83. x1 = 6, n1 = 57, x2 = 12, n2 = 58. The p-value is 0.134. Since p-value $> \alpha$, we fail to reject H_0 at the 10% significance level.

c. Check the assumptions that the test is valid.

ANS:
i. The population is more than 10 times larger than the samples.
ii. There are at least 5 successes (i.e., green m&ms) and 5 failures (i.e., m&ms of other colors) in each sample.

d. Give a 95% CI for the difference in the proportions of green m&ms.

ANS: Use 2-PropZInt on the TI83. The 95% CI for the difference in the proportions of green m&ms is –0.2328 to 0.02957.

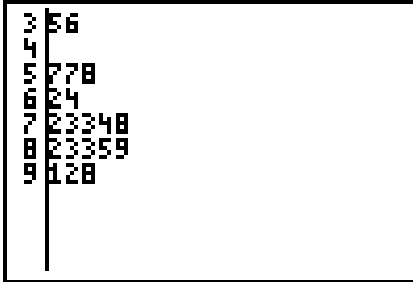2. (25 points) Here are randomly selected test scores from section 01 of calculus:

83	89	36	83	92	91	73	82	62	57
58	74	78	73	98	35	57	85	72	64

Here are randomly selected scores for the same test from section 02 of calculus:

74	79	84	49	38	85	64	68	93	76	81	61
58	73	79	83	88	91	48	19	92	78	86	82

a. Draw a stemplot for the test scores of each section.

ANS: Here is the stemplot for section 01:

Here is the stemplot for section 02:
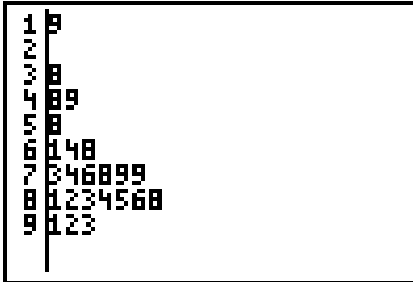
b. Is there enough evidence that section 01 performed worse than section 02 on the test?

ANS:

H_0: $\mu_1 = \mu_2$

H_a: $\mu_1 < \mu_2$

$\alpha = 0.05$ (assumed because a significance level is not given).

Use 2-SampTTest on the TI83 with section 01 scores in list, L_1 and section 02 scores in list, L_2. The p-value is 0.504. Since p-value $> \alpha$, we fail to reject H_0 at the 5% significance level.

c. Is there enough evidence that the test scores were different for the two sections?

ANS:

H_0: $\mu_1 = \mu_2$

H_a: $\mu_1 \neq \mu_2$

$\alpha = 0.05$ (assumed because a significance level is not given).

Use 2-SampTTest on the TI83 with section 01 scores in list, L_1 and section 02 scores in list, L_2. The p-value is 0.991. Since p-value $> \alpha$, we fail to reject H_0 at the 5% significance level.

d. Check the assumptions that the test is valid.

ANS: Since $n_1 + n_2 > 40$, we can use the *t*-test even though the distributions are skewed.

e. Give a 99% CI for the difference in the mean test scores.

ANS: Use 2-SampTInt on the TI83. The 99% CI for the difference in the mean test scores is -14.59 to 14.708.

3. (10 points) A study was done to determine if temperature affects the hatching of snake eggs. The eggs in the study were randomly selected. Here are the data:
ANS: Here's the complete table.

	Not Hatched	Hatched	Eggs (Total)
Cold	11	16	27
Neutral	18	38	56
Hot	29	75	104
Total	58	129	187

a. Are there significant differences among the proportion of eggs that hatched in the three groups?
ANS:
H_0: $p_1 = p_2 = p_3$
H_a: all proportions are not the same
$\alpha = 0.05$ (assumed because a significance level is not given).
Use χ^2-Test on the TI83. The p-value is 0.427. Since p-value $> \alpha$, we fail to reject H_0 at the 5% significance level.

b. Check the assumptions that the test is valid.
ANS: All the expected counts are above 11. Thus all individual expected counts are above 1 and no more than 20% of the expected counts are less than 5.

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4. (15 points) An experiment on the side effects of pain relievers assigned patients randomly to one of several over-the-counter pain medications. Of the 385 patients who took one brand of pain reliever, 25 suffered some "adverse sympton".

a. If 9% of all patients suffer adverse symptoms, what would be the sampling distribution of the proportion with adverse symptoms in a sample of 385 patients?
ANS: The sampling distribution is approximately normal, N(0.09, 0.0146). The mean of the sampling distribution is the mean of the population and the standard deviation is $\sqrt{\dfrac{p(1-p)}{n}}$.

b. Is there strong evidence that fewer than 9% of patients who take this medication have adverse symptoms?
ANS:
H_0: $p_1 = 0.09$
H_a: $p_1 < 0.09$
$\alpha = 0.05$ (assumed because a significance level is not given).
Use 1-PropZTest on the TI83. p0 = 0.09, x = 25, n = 385. The p-value is 0.0429. Since p-value $\leq \alpha$, we reject H_0 and accept H_a. In other words, there is evidence that fewer than 9% of patients who take this medication have adverse symptoms at the 5% significance level.

c. Find a 90% confidence interval for the proportion of patients who have adverse symptoms.
ANS: Use 1-PropZInt on the TI83. The 90% CI for the proportion of adverse symptoms is 0.04428 to 0.08559.

5. (10 points) A major study of alternative weight-loss programs was undertaken. The individuals in the study were randomly placed into one of the two programs. Here is the information released by the researchers:

	n	mean weight loss	standard deviation
Program 1	1362	15	3.5
Program 2	1295	13	3.8

Is there good evidence that there is a difference in weight loss between the two programs?
ANS:
$H_0: \mu_1 = \mu_2$
$H_a: \mu_1 \neq \mu_2$
$\alpha = 0.05$ (assumed because a significance level is not given).
Use 2-SampTTest on the TI83 with x-bar1 = 15, Sx1 = 3.5, n1 = 1362, x-bar2 = 13, Sx2 = 3.8, n2 = 1295. The p-value is $0.1.625774E\text{-}43 \cong 0$. Since p-value $\leq \alpha$, we reject H_0 and accept H_a. In other words, there is evidence that there is a difference in weight loss between the two programs at the 5% significance level.

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 total)(column total)/(table total) = (27)(58)/(187) = 8.37.

7. (5 points) What is the definition of the chi-square statistic?

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