MAT212 Test 3 (Spring 2003)

Sections 12.1,2,4 and 13.1,2,4

Name:

Directions:

- Points for each problem are in parentheses. All answers to be graded must be on this test. Show all work to receive any credit.
- Table values (normal and t) are attached to your test. When using the tables, specify how you obtained a result.

Problem 1 The management of a large corporation (160,000 employees) is considering subjecting employees to a change in their insurance plan. A random sample of 300 employees finds that 52% will support the new plan.

1. (15 points) Estimate with 90% confidence the true proportion of all employees who support the new plan. Be sure to include an interpretation of your interval.

2. (4 points) Verify that the above procedure is valid (i.e., are the conditions for this procedure met?).

3. (6 points) How many employees would need to be sampled to estimate the desired proportion to within a margin of error of 2% when using a 90% level of confidence?

Problem 2: A business person is thinking of opening a food franchise in the area. She believes the operation will be profitable if at least 45% of customers spend $8 or more. A small market survey of 200 shoppers revealed that 97 of them would spend $8 or more during their visit.

1. (4 points) Identify a plausible null and alternative hypothesis for this problem.

2. (5 points) The observed value of the test statistic for this problem is 0.9949. What is the p-value associated with this test statistic?

3. (5 points) Based on your p-value from part 2, what is your decision if the level of significance is .05?

4. (5 points) Give an interpretation based on your results.

5. (5 points) Describe a Type I error in terms of this problem's test.

Problem 3 (15 points) A blend of fuels is combined to create a diesel fuel which is better (reduced sulpher emissions, and better viscosity). The composition is supposed to include 20 grams of "element x" for protection against abrasive engine damage. To judge how well the refinery is achieving this mix, a sample of batches was selected and the content of "element x" (in grams) was recorded. Use the Minitab output to construct and interpret a 99% confidence interval for the mean percentage of "element x" in the fuel blend.

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Descriptive Statistics: x
Variable    N     Mean   Median   TrMean   StDev   SE Mean
x (gms)    49   19.138   19.220   19.192   4.622    0.660
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Problem 4: Two companies with two different processes are competing for a contract with The Giant Company to make a petrochemical. The two companies are challenged to produce evidence of the costs associated with the processing. The two companies provide the following data:

1. Company 1: \$319 average cost, standard deviation of 351, 124 samples.
2. Company 2: \$435 average cost, standard deviation of 406, 98 samples.

Executives are inclined to engage company 1, but wonder if the difference in costs is statistically significant. Company officials are comfortable with a 95% confidence level.

1. (6 points) Propose a reasonable test, and compute the value of the test statistic.

2. (5 points) What is your decision for the hypothesis test?

3. (5 points) What is your interpretation of the results?

Problem 5: In a marketing study of the effects of a particular advertising campaign, stores are carefully matched on demographic parameters and then dollar sales figures are generated for the product in question.

	N	Mean	StDev
With campaign	55	9074	2276
Without campaign	55	8553	2854
Difference	55	521	1855

The company is comfortable with a 5% significance level to test for differences in sales based on the campaign.

1. (4 points) State reasonable null and alternative hypotheses for this problem.

2. (4 points) What is the test statistic?

3. (4 points) What is the p-value for this test?

4. (4 points) Based on your p-value, give your decision for the test.

5. (4 points) Give an interpretation of the test results.

t/df	48	49	54	55	220	222	∞
0.1	0.040	0.040	0.040	0.040	0.040	0.040	0.040
0.2	0.079	0.079	0.079	0.079	0.079	0.079	0.079
0.3	0.117	0.117	0.117	0.117	0.118	0.118	0.118
0.4	0.155	0.155	0.155	0.155	0.155	0.155	0.155
0.5	0.190	0.190	0.190	0.190	0.191	0.191	0.191
0.6	0.224	0.224	0.224	0.225	0.225	0.225	0.226
0.7	0.256	0.256	0.257	0.257	0.258	0.258	0.258
0.8	0.286	0.286	0.286	0.286	0.288	0.288	0.288
0.9	0.314	0.314	0.314	0.314	0.315	0.315	0.316
1.0	0.339	0.339	0.339	0.339	0.341	0.341	0.341
1.1	0.362	0.362	0.362	0.362	0.364	0.364	0.364
1.2	0.382	0.382	0.382	0.382	0.384	0.384	0.385
1.3	0.400	0.400	0.400	0.400	0.403	0.403	0.403
1.4	0.416	0.416	0.416	0.416	0.419	0.419	0.419
1.5	0.430	0.430	0.430	0.430	0.432	0.432	0.433
1.6	0.442	0.442	0.442	0.442	0.444	0.444	0.445
1.7	0.452	0.452	0.453	0.453	0.455	0.455	0.455
1.8	0.461	0.461	0.461	0.461	0.463	0.463	0.464
1.9	0.468	0.468	0.469	0.469	0.471	0.471	0.471
2.0	0.474	0.474	0.475	0.475	0.477	0.477	0.477
2.1	0.479	0.480	0.480	0.480	0.482	0.482	0.482

Table 1: T-table giving probability P($0 < t < T$) (normal values are given under ∞ df).

df/α	0.1	0.05	0.025	0.01	0.005
∞	1.282	1.645	1.960	2.326	2.576
49	1.299	1.677	2.011	2.407	2.682

Table 2: Critical values of the normal and a t.

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$$\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2,df} \sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

$$\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2,df} \sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}$$

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\left(\frac{(s_1^2/n_1)^2}{n_1 - 1} + \frac{(s_2^2/n_2)^2}{n_2 - 1}\right)}$$