KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
DHAHRAN, SAUDI ARABIA

STAT 212: BUSINESS STATISTICS II
Semester 051
Mid Term Exam No.1
Sunday October15, 2005
7:00 – 8:30 pm

Please **circle** your instructor's name:

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Name: ID#: Section: Serial:

Question No	Full Marks	Marks Obtained
1	5	
2	5	
3	7	
4	7	
5	12	
6	7	
7	7	
Total	50	

1. (5 Marks) Answer the following questions by indicating it is **T**rue or **F**alse.

a. Type II error occurs when accepting the null hypothesis while it is true.

b. The larger the p-value, the more we doubt the null hypothesis.

c. The normality assumption is required always for testing the difference between two population means regardless of the sample size.

d. When comparing two independent population means by using large samples selected from populations with equal variances, the correct test statistic to use is **z.**

e. In testing the difference between two population variances, it is a common practice to compute the F statistic so that its value is always greater than or equal to one.

2. (5 Marks) Answer the following questions by choosing the right answer.

1. When formulating a hypothesis test, which of the following statements is **true**:

   a) The null hypothesis should never contain the equality.
   b) The null and alternative hypotheses should be stated in terms of the population value.
   c) If possible, the research hypothesis should be formed as the null hypothesis.
   d) The null hypothesis should be established such that the chance of making a Type I error is minimized.

2. For a given hypothesis test, if we do not reject H_0, and H_0 is true

   a) No error has been committed.
   b) Type I error has been committed.
   c) Type II error has been committed.
   d) Type III error has been committed.

3. The t-test for the mean difference between two related populations assumes that the respective.

   a) The population variances are equal.
   b) The null hypothesis states that the population means are equal.
   c) The alpha level is 0.10 or higher.
   d) None of the above.

4. In testing the difference between the means of two normally distributed populations using large, independent random samples, the correct test statistic to use is:

   e) Z statistic
   f) t statistic
   g) F statistic
   h) Chi-square statistic

5. If a hypothesis test for a single population variance is to be conducted, which of the following statements is **true**?

   a) The null hypothesis must be stated in terms of the population variance.
   b) The Chi-square distribution is used.
   c) If the sample size is increased, the critical value is also increased for a given level of statistical significance.
   d) All of the above are true.

3. (8 Marks) A random sample of 25 European professional soccer players has an average age of 27 years. The sample standard deviation is 4 years. We would like to decide if there is enough evidence to establish that average age of European soccer players is more than 26 years.

a) What are the null and alternative hypotheses?

b) What is the rejection region in terms of years of age? Use $\alpha = .05$?

c) Perform the test.

d) What is your decision?

e) What are the assumptions that you need to answer the question?

4. (8 Marks) A contract with a parts supplier calls for no more than .04 defects in the large shipment of parts. To test whether the shipment meets the contract, the receiving company has selected a random sample of n = 100 parts and found 6 defects. If the hypothesis test is to be conducted using a significance level equal to 0.05.then:

a) The hypotheses are: H_0: H_A:

b) What are the assumptions?

c) What is the test statistic?

d) What is the p-value?

e) What is the decision rule?

f) What is the conclusion?

5. (12 Marks) A fast food company uses two management-training methods. Method 1 is a traditional method of training and Method 2 is a new and innovative method. The company has just hired 31 new management trainees. 15 of the trainees are randomly selected and assigned to the first method, and the remaining 16 trainees are assigned to the second training method. After three months of training, the management trainees took a standardized test. The test was designed to evaluate their performance and learning from training. The sample mean score and sample standard deviation of the two methods are given below.

	Mean	Standard deviation
Method 1	69	3.4
Method 2	72	3.8

a. Is there sufficient evidence to conclude that the new training method is more effective than the traditional training method? What is the decision at $\alpha = .05$?

b. What are the assumptions that you need to answer part a.

c. Test the hypothesis: H$_o$: $H_o: \sigma_1^2 = \sigma_2^2 \quad vs. \quad H_a: \sigma_1^2 \neq \sigma_2^2$, using α = 0.10. What can you say about your assumptions in part **b**.

6. (8 Marks) Let p_1 represent the population proportion men who are in favor of a new tax on "junk food". Let p_2 represent the population proportion of women who are in favor of a new tax on "junk food". Out of the 265 men sampled 106 of them are in favor of a "junk food" tax. Out of the 285 women only 57 of them are in favor a "junk food" tax. At α = .01, can we conclude that the proportion of men who favor "junk food" tax is more than 5% higher than proportion of women who favor the new tax?

7. (8 Marks) A national call center that provides assistance to customers of a major electronics company has a standard that insists that the call time standard deviation not exceed 1.5 minutes. To test whether this standard is being met, a random sample of 20 calls was selected and yields a standard deviation of 2.04 minutes. (α = .05)

Chapter 8

1. Testing hypotheses about μ

a. For large sample or known σ, z values are used.

b. For small sample and unknown σ, t values are used.

The test statistics are

$$z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$ or

$$t_{n-1} = \frac{\bar{x} - \mu}{s / \sqrt{n}}$$ will be compared with

a. z_α or t_α for one tailed hypotheses.

b. $z_{\alpha/2}$ or $t_{\alpha/2}$ for two tailed hypotheses.

2. Testing hypotheses about *p*

The test statistic

$$z = \frac{\bar{p} - p}{\sqrt{p(1-p)/n}}$$ where $\bar{p} = \frac{x}{n}$

under the

Chapter 9

1. Testing hypotheses about the match paired

The i[th] paired difference is

$$d_i = x_{1i} - x_{2i}$$

Test statistic is $t_{n-1} = \dfrac{\bar{d} - \mu_d}{s_d / \sqrt{n}}$

where $\bar{d} = \dfrac{1}{n}\sum_{i=1}^{n} d_i$ and

$$s_d = \sqrt{\sum_{i=1}^{n} (d_i - \bar{d})^2 / (n-1)}.$$

2. Testing difference between two independent population means

a. If σ_1 and σ_2 known or n_1 and $n_2 \geq 30$

The test statistics is

$$z = \frac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{(\sigma_1^2 / n_1) + (\sigma_2^2 / n_2)}}$$

b. If σ_1 and σ_2 unknown or n_1 and $n_2 \geq 30$, the test statistic is

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

c. If σ_1 and σ_2 unknown or n_1 or $n_2 < 30$ (assuming equal σ's)

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

where

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

d. If σ_1 and σ_2 unknown or n_1 or $n_2 < 30$ (assuming unequal σ's), the test statistic

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

with degree of freedoms

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

3. To test hypotheses about difference between two independent proportions

The test statistic is

$$z = \frac{\left(\bar{p}_1 - \bar{p}_2\right) - \left(p_1 - p_2\right)}{\sqrt{\bar{p}\,(1 - \bar{p})\,\left((1/n_1) + 1/n_2\right)}}$$

where

$$\bar{p} = \frac{n_1 \bar{p}_1 + n_2 \bar{p}_2}{n_1 + n_2} = \frac{x_1 + x_2}{n_1 + n_2}$$

Chapter 10

1. Testing hypotheses about σ

The test statistic is

$$\chi^2 = (n-1)s^2 / \sigma_0^2$$

which has a χ^2 distribution with $df = n - 1$

and σ_0^2 is hypothetical.

2. Testing hypotheses about $\sigma_1^2 - \sigma_2^2$

The test statistic is

$F_0 = s_1^2 / s_2^2$ with $df_1 = n_1 - 1$

and $df_2 = n_2 - 1$.