

Name _____ Student ID _____

Prince of Songkla University
Department of Industrial Engineering, Faculty of Engineering

Final Examination: Semester 2

Academic Year: 2003

Date: 26 February 2004

Time: 9.00-12.00 PM

Subject: 225-244 Engineering Statistics I

Room: R 300

Instructions: Read them carefully

1. All materials are allowed.
2. There are 6 problems, and work all of them. Also show your work clearly and legibly.
3. Answer your questions in this test paper, only.
4. You must write your name and your student ID in every page of the test.
5. Total score is 100 points.

Distribution of Scores

Problem	Points	(a)	(b)
1	15	7	8
2	15	6	9
3	20		
4	20		
5	15	7	8
6	15	10	5

ทูลจริตใการสอบ โทษขัันต่ำปรับตกใรายวิชานััน และพักการเรียน
1 ภาคการศึกษา โทษสูงสุดให้ออก

Tests are prepared by
Nikorn Sirivongpaisal

Name _____ Student ID _____

Problem 1: (15 points) A random sample of size $n_1 = 16$ is selected from a normal population with a mean of 75 and a standard deviation of 8. A second random sample of size $n_2 = 9$ is taken from another normal population with a mean of 70 and a standard deviation of 12. Let \bar{X}_1 and \bar{X}_2 be the sample mean of two random samples. Find

a) The probability that $\bar{X}_1 - \bar{X}_2 > 4$.

b) The probability that $3.5 \leq \bar{X}_1 - \bar{X}_2 \leq 5.5$.

Name _____ Student ID _____

Problem 2: (15 points) Do the following problems.

- a) The concentration of ingredient in a liquid detergent is thought to be affected by the type of catalyst used in the process. Ten observations of concentration are taken with each catalyst, and the data are shown below. Find a 95% two-sided confidence interval on the ratio of the two variances σ_1^2/σ_2^2 .

Sample	1	2	3	4	5	6	7	8	9	10
Catalyst 1	57.9	66.2	65.4	65.4	65.2	62.6	67.6	63.7	67.2	71.0
Catalyst 2	66.4	71.7	70.3	69.3	64.8	69.6	68.6	69.4	65.3	68.8

- b) The fraction of defective product produced by two production lines is being analyzed. A random sample of 100 units from line 1 has 10 defectives, while a random sample of 120 units from line 2 has 25 defectives. Find a 99% two-sided confidence interval on the difference in fraction defective produced by the two lines. Do you think there is any difference between fraction defective of line 1 and line 2?

Name _____ Student ID _____

Problem 3: (20 points) Consider the data in Problem 2a). Suppose that it is important to show that there is no difference in mean concentration of ingredient in a liquid detergent by using two types of catalyst. Formulate and test appropriate hypotheses using these data. What is your conclusions at $\alpha = 0.05$?

Name _____ Student ID _____

Problem 4: (20 points) Two different analytical tests can be used to determine the impurity level in steel alloys. Eight specimens are tested using both methods, and the results are shown in the following table. Is there sufficient evidence to conclude that both tests give the same mean impurity level, using $\alpha = 0.01$.

Specimen	1	2	3	4	5	6	7	8
Test 1	1.2	1.3	1.5	1.4	1.7	1.8	1.4	1.3
Test 2	1.4	1.7	1.5	1.3	2.0	2.1	1.7	1.6

Name _____ Student ID _____

Problem 5: (15 points) Regression methods were used to analyze the data from a study investigating the relationship between roadway surface temperature (x), and roadway crack (y). Summary quantities were $n = 20$, $\sum y_i = 12.75$, $\sum y_i^2 = 8.86$, $\sum x_i = 1478$, $\sum x_i^2 = 143,215.8$, and $\sum x_i y_i = 1083.67$.

a) Use the equation of regression line to predict what roadway crack would be observed when the roadway surface temperature is $85^\circ F$.

b) Test for significance of regression ($\beta_1 = 0$) using $\alpha = 0.05$, what is your conclusions?

Name _____ Student ID _____

Problem 6: (15 points) An experiment was run to determine whether four specific temperatures affect the density of a certain type of brick. The experiment showed the following data.

Temp. (Fahrenheit)	Density						
100	21.8	21.9	21.7	21.6	21.7	21.5	21.8
125	21.7	21.4	21.5	21.5	-	-	-
150	21.9	21.8	21.8	21.6	21.5	-	-
175	21.9	21.7	21.8	21.7	21.6	21.8	-

a) Does the temperature affect the density of the bricks? Use $\alpha = 0.05$.

b) Find the P -value for the test in part (a) above.