

Name \_\_\_\_\_ Student ID \_\_\_\_\_

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

Mid Term Examination: Semester 1  
Date: 6 August 2005  
Subject: 225-502 Experimental Designs

Academic Year: 2005  
Time: 9.00 – 12.00  
Room: R 200

ทฤษฎีในการสอบ โทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทฤษฎี และพักการเรียนหนึ่งภาคการศึกษา

**Instructions: Read carefully**

1. All materials are allowed.
2. There are 5 problems, do all of them. Also show your work clearly and legibly.
3. Answer the 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 Score**

Problem	Points	(a)	(b)
1	20	-	-
2	20	10	10
3	15	-	-
4	20	-	-
5	25	-	-

Tests are prepared by  
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**Problem 1: (20 points)** A new filtering device is installed in a chemical unit. Before its installation, a random sample yielded the following information about the percentage of impurity:  $\bar{y}_1 = 12.5$ ,  $S_1^2 = 101.17$ ,  $n_1 = 8$ . After installation, a random sample yielded  $\bar{y}_2 = 10.2$ ,  $S_2^2 = 94.73$ ,  $n_2 = 8$ . Has the filtering device reduced the percentage of impurity significantly? Use  $\alpha = 0.05$ .



**Problem 2: (20 points)** Four catalysts that may affect the concentration of liquid mixture are being investigated. The following concentrations are followed:

Catalyst			
1	2	3	4
58.2	56.3	50.1	52.9
57.2	54.5	54.2	49.9
58.4	57.0	55.4	50.0
55.8	55.3		51.7
54.9			

- (a) Do the four catalysts have the same effect on the concentration of liquid mixture? Use  $\alpha = 0.05$  (Analyze data only, just ignore model adequacy checking step)

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(b) Use Tukey's test to compare pairs of treatment means. Use  $\alpha = 0.05$

*Ken Ah*

**Problem 3: (15 points)** A kicker for a college football team desires to test three brands of kicking shoes to see which gives him the longest distance kicks. From past performance, he knows that his average kick travels 66 yards, with a standard deviation of 3 yards. He is interested in detecting a difference of 10 yards from shoe to shoe. How many kicks must he make with each shoe to detect this difference with  $\alpha = 0.05$  and  $\beta = 0.10$ .

**Problem 4: (20 points)** A professor suspects that his five teaching assistants (TA) are giving different grades to students who are performing comparably. To test this hypothesis, he makes photocopies of six tests and give all six to each teaching assistant. They come back with the following grades.

TA	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
1	68	91	77	88	88	53
2	72	94	78	90	90	57
3	69	89	77	91	91	55
4	74	93	80	91	91	54
5	65	87	78	86	86	50

From above data, are five teaching assistants giving different grades to students? Use  $\alpha = 0.05$ .

**Problem 5: (25 points)** The shear strength of an adhesive is thought to be affected by the application pressure and temperature. A factorial experiment is performed in which both factors are assumed to be fixed. Analyze the data and draw conclusions. Use  $\alpha = 0.05$ .

Pressure (lb/in <sup>2</sup> )	Temperature (°F)		
	250	260	270
120	9.60	11.28	9.00
130	9.69	10.10	9.57
140	8.43	11.01	9.03
150	9.98	10.44	9.80