

Name _____ Student ID _____

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

Final Examination: Semester 1

Date: 8 October 2005

Subject: 225-491 Problem Solving with Statistical Techniques

Academic Year: 2005

Time: 0900-1200

Room: R 300 Com 2

ทฤษฎีในการสอบ โทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทฤษฎี และพักการเรียนหนึ่งภาคการศึกษา

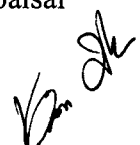
Instructions: Read carefully

1. All materials are allowed, also personal computer.
2. There are 5 problems, do all of them. Also show your work clearly and legibly.
3. Answer the questions in the answer book, 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
1	20
2	20
3	20
4	20
5	20

Tests are prepared by
Nikorn Sirivongpaisal



Problem 1: (20 points) Data below are values of the hardness of a steel product and the percentage of ingredient in the raw material used. The data were collected by measuring the hardness of the product corresponding to raw material lots.

% Ingredient	Hardness	% Ingredient	Hardness	% Ingredient	Hardness	% Ingredient	Hardness
0.52	26.2	0.76	28.7	0.45	26.2	0.18	20.1
0.58	25.4	0.40	24.6	0.38	21.9	0.21	23.5
0.66	24.2	0.24	22.4	0.67	25.4	0.45	26.4
0.18	22.7	0.94	31.0	0.37	23.6	0.93	31.8
1.00	30.0	0.94	29.8	1.03	28.4	0.70	27.2
0.71	26.9	0.90	30.3	0.29	23.9	0.41	23.3
0.87	27.0	0.52	25.1	0.70	24.5	0.40	26.4
0.36	25.3	0.45	23.5	0.58	25.1	0.65	26.4
0.62	25.6	0.73	28.4	0.59	26.5	0.63	27.1
0.73	27.3	0.28	23.6	0.20	24.1	0.87	30.5

Use appropriate tool to analyze the relationship between two different sets of data.

Problem 2: (20 points) The industrial engineer are studying a specific process in chemical industry. He is interested in whether two different formulations affect the burning times of chemical flares or not. The following data are the burning times of chemical flares of two different formulations. If you were this industrial engineer, what are your conclusions about this problem?

Formulation 1		Formulation 2	
65	82	64	56
81	67	71	69
57	59	83	74
66	75	59	82
82	70	65	79

Name _____ Student ID _____

Problem 3: (20 points) From problem solving project in a company, an experiment was run to determine whether four specific firing temperature affect the density of a certain type of brick. The experiment led to the following data.

Temperature	Density				
100	21.8	21.9	21.7	21.6	21.7
125	21.7	21.4	21.5	21.4	
150	21.9	21.8	21.8	21.6	21.5
175	21.9	21.7	21.8	21.4	

What will you conclude this study?

Handwritten signature

Problem 4: (20 points) Assume you are quality control engineer of a fabric finishing plant, now your department is working on project about quality improvement program. Your project team is studying the effect of several factors on the dyeing cotton. Three operators, three cycle times, and two temperatures were selected, and three small specimens of cloth were dyed under each set of conditions. The finished cloth was compared to a standard, and a numerical score was assigned. The resulting data follow. What will you conclude this study?

Cycle Time	Temperature					
	300°			350°		
	Operator			Operator		
	1	2	3	1	2	3
40	23	27	31	24	38	34
	24	28	32	23	36	36
	25	26	29	28	35	39
50	36	34	33	37	34	34
	35	38	34	39	38	36
	36	39	35	35	36	31
60	28	35	26	26	36	28
	24	35	27	29	37	26
	27	34	25	25	34	24

Handwritten signature

Problem 5: (20 points) An experiment was performed to analyze root causes of problem. Data from this experiment are shown in the following table. Analyze the data and draw conclusions what are root causes of the problem.

Treatment Combination	Replicate		Treatment Combination	Replicate	
	I	II		I	II
(1)	90	93	<i>d</i>	98	95
<i>a</i>	74	78	<i>ad</i>	72	76
<i>b</i>	81	85	<i>bd</i>	87	83
<i>ab</i>	83	80	<i>abd</i>	85	86
<i>c</i>	77	78	<i>cd</i>	99	90
<i>ac</i>	81	80	<i>acd</i>	79	75
<i>bc</i>	88	82	<i>bcd</i>	87	84
<i>abc</i>	73	70	<i>abcd</i>	80	80

Van Sh