

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

Final Examination: Semester 2

Academic Year: 2004

Date: 2 March 2005

Time: 9.00 – 12.00 AM

Subject: 225-244 Engineering Statistics I

Room: R300

**Instruction: Read them carefully**

1. You must write your name and your student ID in every page of the test.
2. All materials are allowed.
3. There are 7 problems and total score is 90 points, work all of them and also show your work clearly and legibly.
4. Answer your questions in this test paper only.

ทจรจรดในการสอบ โทษขั้ันต่ำปรบรตทในรายวฤษานั้ และพ้กการเรยร่น 1 ภาคการศีกษา  
โทษสูงสด ให้ออก

## Distribution of Scores

Problem	Points	
1	10	
2	10	
3	15	
4	15	
5	15	
6	15	
7	10	
<b>รวม</b>	<b>90</b>	

Tests are arranged by  
 Napisorn Memongkol



1. The average life of a microwave oven is 7 years, with a standard deviation of 1 year. Assuming that the lives of these ovens follow approximately a normal distribution, find
  - a) The probability that the mean life of a random sample of 9 such ovens falls between 6.4 and 7.2 years (5 points)
  - b) The value of  $\bar{x}$  to the right of which 20% of the means computes from random samples of size 9 would fall. (5 points)



2. A survey of 1000 students concluded that 274 students chose a professional baseball team, A as his or her favorite team. In 1991, the same survey was conducted involving 760 students. It concluded that 240 of them also chose team A as their favorite. Compute a 95% confidence interval for the difference between the proportion of students favoring team A between the two surveys. Is there a significant difference?  
(10 points)



3. A study was made to determine if the subject matter in a physics course is better understood when a lab constitutes part of the course. Students were randomly selected to participate in either a 3-semester-hour course without labs or a 4-semester-hour course with labs. In the section with labs 11 students made an average grade of 85 with a standard deviation of 4.7, and in the section without labs 17 students made an average grade of 79 with a standard deviation of 6.1. Would you say that the laboratory course increases the average grade by as much as 8 points? Use a 0.05 level of significance and assume the populations to be approximately normally distributed with equal variances. (15 points)



4. Ten individuals have participated in a diet-modification program to stimulate weight loss. Their weight both before and after participation in the program is shown in the following list. Is there evidence to support the claim that this particular diet-modification program is effective in producing a mean weight reduction? Use  $\alpha = 0.05$ . (15 points)

Subject	Before	After
1	195	187
2	213	195
3	247	221
4	201	190
5	187	175
6	210	197
7	215	199
8	246	221
9	294	278
10	310	285



5. An article in *Wear* presents data on the fretting wear of mild steel and oil viscosity. Representative data follow, with  $x$  = oil viscosity and  $y$  = wear volume ( $10^{-4}$  cubic millimeters) (15 points)

<b>y</b>	240	181	193	155	172	110	113	75	94
<b>x</b>	1.6	9.4	15.5	20.0	22.0	35.5	43.0	40.5	33.0

- Find the equation of the regression line.
- Predict fretting wear when viscosity  $x = 30$ .
- Calculate  $r$

6. A study on the *Effect of Magnesium Ammonium Phosphate on Height of Chrysanthemums* was conducted at George Mason University to determine a possible optimum level of fertilization, based on the enhanced vertical growth response of the Chrysanthemums. Forty Chrysanthemums seedlings were divided into 4 groups each containing 10 plants. Each was planted in a similar pot containing a uniform growth medium. To each group of plants an increasing concentration of  $MgNH_4Po_4$ , measured in grams per bushel, was added. The 4 groups of plants were grown under uniform conditions in a greenhouse for a period of four weeks. The treatments and the respective changes in heights, measured in centimeters, are shown in the following table (15 points)

Treatment			
50 g/bushel	100 g/bushel	200 g/bushel	400 g/bushel
13.2	16.0	7.8	21.0
12.4	12.6	14.4	14.8
12.8	14.8	20.0	19.1
17.2	13.0	15.8	15.8
13.0	14.0	17.0	18.0
14.0	23.6	27.0	26.0
14.2	14.0	19.6	21.1
21.6	17.0	18.0	22.0
15.0	22.2	20.2	25.0
20.0	24.4	23.2	18.2

Can we conclude at the 0.05 level of significance that different concentrations of  $MgNH_4Po_4$  affect the average attained height of Chrysanthemums? Assume the populations are approximately normally distributed with equal variances.

7. The following data represent the number of hours that two different types of scientific pocket calculators operate before a recharge is required. (10 points)

Calculator A	5.5	5.6	6.3	4.6	5.3	5.0	6.2	5.8	5.1
Calculator B	3.8	4.8	4.3	4.2	4.0	4.9	4.5	5.2	4.5

Use the Wilcoxon rank-sum test with  $\alpha = 0.01$  to determine if calculator A operates longer than calculator B on a full battery charge.