PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester II — Academic Year: 2006
Date: February 26, 2006 — Time: 13.30-16:30
Subject: 225-384 Fundamental of Engineering Statistics — Room: A401

Instructions

- Write your name and student ID on the answer book and exam paper.
- Submit both answer book and exam paper, otherwise no score.
- Write your answer in the answer book only, show your work clearly and legibly.
- This is an opened-book examination.
- There are 6 problems and total score is 105.
- Carefully read the problems and answer all questions in each problem.

Name..... ID Code .....

ทุจริตในการสอบ โทษขั้นต่ำ คือ พักการเรียน 1 ภาคการศึกษา และปรับตกในรายวิชาที่ทุจริต

Problem#	Full Score	Assigned score
1	10	
2	10	
3	25	
4	15	
5	20	
6	25	
Total	105	

Do your best and good luck

Thanate Ratanawilai

1. **(10 points)** The medical school is interested in whether the average blood alcohol content of males was higher than females for people who were in accidents where drivers were under 26 years old and there was alcohol and property damage involved. Test this hypothesis at the .05 level of significance.

Automobile Accident Investigation by the medical school.

Gender	Age	Alcohol Female Level	Property Damage	People Killed	Parent's Convictions
F	21	1.1	1,000	0	0
F	22	1.2	2,000	0	0
F	25	1.1	1,000	0	0
F	17	1.1	15,000	0	0
F	19	1.5	70,000	2	2
F	21	1.1	1,000	0	0
F	21	1.2	2,500	0	0
F	21	1.2	15,000	0	0
F	24	1.2	10,000	0	1
F	21	1.1	1,500	0	0
F	22	1.1	2,000	0	0

Gender	Age	Male Level	Damage	Killed	Convictions
M	15	1.1	20,000	0	1
M	21	1.1	1,500	0	0
M	16	1.4	28,000	1	0
M	22	1.2	1,500	0	0
M	19	1.7	42,000	1	0
M	20	2.4	150,000	4	1
M	21	1.3	5,000	0	0
M	21	1.4	25,000	0	0
M	21	1.4	35,000	1	0
M	22	1.1	1,000	0	0
M	23	1.1	10,000	0	0
M	24	1.1	5,000	1	0
M	18	1.6	35,000	2	1
M	17	1.5	30,000	1	2
M	21	1.2	2,000	0	0
M	15	1.2	22,000	0	1
M	20	1.2	10,000	0	0
M	21	1.4	30,000	0	1
M	21	1.3	5,000	0	0

2. **(10 points)** An experiment was conducted to compare the filling capability of two packaging equipments. Ten bottles of product from Equipment "A" were randomly selected and measured, along with 10 bottles of product from Equipment "B". The data are as follows (fill volume is in millimeters):

Equipment "A"		Equipment "B"	
755	751	756	756
753	752	755	757
752	753	755	756
751	753	754	756
753	754	756	755

Perform an appropriate statistical hypothesis testing procedure to determine whether the variance of fill volume from Equipment "A" is significantly different from the variance of fill volume from Equipment "B". In reaching your conclusion, use $\alpha = 0.10$.

3. **(25 points)**

3.1 The following table gives the number of kilometers per litre obtained by similar automobiles using five different brands of gasoline. Determine whether there is a difference between the brands at significance level of 0.05 and 0.01.

Brand A	11	12	11	10	13	12
Brand B	12	11	13	10		
Brand C	10	11	9	12		
Brand D	13	14	13	13	12	
Brand E	10	11	12	11	9	13

3.2 Test the hypothesis at the 0.01 level of significance that the population variance of the five brands is equal.

4. **(15 points)**

4.1 Find the probability of getting between 40 and 60 heads inclusive in 100 tosses of a fair coin.

4.2 To test the hypothesis ($\alpha = 0.10$) that a coin is fair, adopt the following decision rule:

- **Accept the hypothesis** if the number of heads in a single sample of 100 tosses is between 40 and 60 inclusive.
- **Reject the hypothesis** otherwise.

Find the probability of rejecting the hypothesis when it is actually correct.

4.3 Based on the decision rule of Problem 4.2, what conclusions would you draw if the sample of 100 tosses yielded 51 heads? And if it yielded 61 heads?

5. **(20 points)**

5.1 The mean weight of 50 male students who showed above-average participation in college athletics was 68.2 kg with a standard deviation of 2.5 kg, while 50 male students who showed no interest in such participation had a mean weight of 67.5 kg with a standard deviation of 2.8 kg. Test the hypothesis that male students who participate in college athletics are heavier than other male students. Test this hypothesis at the .05 level of significance.

5.2 By how much should the sample size of each of the two groups in Problem 5.1 be increased in order that the observed difference of 0.7 kg in the mean weights be significant at the 0.05 levels.

6. **(25 points)** The U.S. consumer price indexes for food and medical-care costs during the years 1997-2005 compared with prices in the base year, 1995 (taken as 100), is shown in the following table.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
Food (X)	175	181	192	211	235	255	275	286	282
Medical care (Y)	169	185	202	219	240	266	295	329	357

6.1 Graph the line on a scatter diagram.

6.2 Find the equation of the regression line.

6.3 Estimate the cost of medical care when the cost of food is 250.

6.4 Compute the correlation coefficient between the two indexes and explain the result.

6.5 Test whether the linear model is adequate.