UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, DECEMBER 1997

Fourth Year - Program 4

Exam Type: A

MIE566F - Decision Analysis

Examiner: Eddie Hsu

Total marks of examination 100
This will count for 40% of the final grade.
Non-programmable calculators permitted

6 1. How could dissonance reduction lead a person into committing the sunk cost fallacy?

8 2. Briefly explain why transitivity might not hold in a voting process. If necessary, use an example to illustrate your point.

3. Two companies are both trying to market a new product simultaneously but they disagree on a set of standards. Each would rather the other company followed their standard. Failing that, they would prefer to agree on a joint standard. If they can't agree then each company prefers to compete against one another with their respective standards. The worst outcome would be if both companies decided to adopt the other's standard. The payoffs for each outcome are given in the table below.

		Company B	
		A's Standard	B's Standard
Company A	A's Standard	5, 3	0, 2
	B's Standard	-1, -2	3, 5

Payoff to: (Company A, Company B)

2 a) Are there any pure strategies leading to a Nash equilibrium? If so, what are they?

6 b) Determine the mixed strategy for each company leading to a Nash equilibrium.

4 c) What is the expected payoff for each player?

12 4.a) Suppose that we have no basis for making any assumptions about the probabilities of the following states. Determine the optimal action under each of the following decision rules: Laplace, Maximin, Maximax, and Savage Minimax Regret.

		Actions					
		a1	a2	a3	a4	a5	a6
States	$\theta 1$	2	6	4	4	5	7
	$\theta 2$	8	2	5	2	4	2
	$\theta 3$	0	5	2	4	3	3
	$\theta 4$	3	5	2	5	3	2

8 b) In the Hurwitz rule we used a coefficient of optimism, $0 \leq \alpha \leq 1$, where $\alpha = 0$ is totally pessimistic and $\alpha = 1$ is totally optimistic. Calculate the optimal decisions

for all values of α between 0 and 1. [Hint: dominance can be used to simplify the problem]

5. You've been called in as a consultant to review the operations of a bank. The bank has a number of teams which work on different projects. Larger teams work on larger projects which frequently have large returns while smaller teams handle smaller scale projects.

   The bank is interested in revamping their business practices and so is interested in identifying problems in its methods -- particularly the manner in which projects are handled. There has been some concern that larger teams and, correspondingly, larger projects are not an efficient use of the bank's resources. It may be better to operate with smaller tightly-knit teams and have more coordination among teams rather than have large project groups operating independently.

   As a preliminary analysis to see if there is any basis for the bank's concern you decide to do a quick Data Envelopment Analysis (D.E.A.) to analyze the efficiency of the teams.

   The size of each team (in number of people) and average yearly revenue attributed to them (in millions of dollars) are provided in the following table:

Team Designation	*Team Size*	*Average Yearly Revenue*
Operations	10	90
Re-engineering	5	70
Investment	8	90
Information Services	20	200
Corporate	12	140

6 a) Formulate a Linear Program of the problem to determine the efficiency of the Information Services team.

6 b) Draw a graphical representation of the problem.

6 c) Solve the Linear Programming problem. [Hint: You should be able to solve the LP inequalities by inspection.] What is the efficiency of the Information Services team?

6 d) Determine the most efficient team based on the solution determined above. (i.e., who is the Information Services team being compared to?)

6. Suppose that you have decided to buy a new car. Just to keep things simple, you decide that the only really important criteria in your decision are price and safety. Since you are an intelligent decision maker, you go around to all the dealers, collect brochures, test drive several, read consumer reports, etc. You finally narrow down your choice to four possible cars.

Car	A	B	C	D
Price (in thousand $)	14	22	28	33
Safety	.3	.4	.6	.9

where "safety" reflects the estimated probability of walking away from an accident after a collision at 80km/hr.

In order to make your decision, you decide to use multi-attribute utility theory.

6 a) First you must determine that "Price" and "Safety" are utility independent. Explain what this means and briefly describe how you would verify it.

6 b) Next you compute your own utility curve for the attribute: "price". Explain how you would do this.

4 c) Suppose you discovered your utility curves for both price and safety were:

Price (in thousands $)	14	25	28	30	33
Utility	1	.75	.5	.25	0

and

Safety	.3	.34	.41	.52	.90
Utility	0	.25	.5	.75	1.0

Draw the two utility curves.

6 d) Finally you determine that the most expensive but safest car has an overall utility of .4 and the cheapest but most dangerous car has a utility of .3. Describe an experiment that you would use (a lottery) to obtain these numbers

8 e) Compute the overall utility of the four different cars. Show your work clearly. Which car is best for you given the two utility functions.