Department of Mechanical & Industrial Engineering
University of Toronto

FINAL EXAMINATION, DECEMBER 2001

Fourth Year - Program 5
MIE 566F - Decision Analysis

Exam Type: A

Examiner: E. Lewin

Notes:
1. Non programmable calculators permitted.
2. 100 marks representing 50% of the course mark.

1 The vice president of Harling Equipment needs to select a new director of marketing. The two candidates are Bill Jacobs and Sue Flowers. The criteria (objectives) sought to be more relevant in the selection are: leadership ability (L), personal skills (P) and administrative skills (A). The following pairwise comparison were established:
Leadership ability is twice as important as personal skills.
Personal is 3 times as important as administrative skills.
Leadership ability is five times as important as administrative skills.

The score of each candidate on each objective is as follows:

	Jacobs	Flowers
L	0.6	0.4
P	0.3	0.7
A	0.4	0.6

Use the AHP Method and do the following:

3 a. Construct a matrix of the pairwise comparisons
8 b. Which candidate should be selected as the new director of marketing?
4 c. Check the pairwise comparison matrix for consistency. (RI for n=3 is 0.58)

2 The figures in the following matrix represent the sums of money paid by the Column Player to the Row Player, when each chooses his alternative.

	Column Player			
Row Player	-1	-1	0	4
	3	2	-2	1

5 a. Find the mixed strategy of the Row Player and draw a graph of it.

5 b. Find the mixed strategy of the Column Player and draw a graph of it.

5 c. Find the expected value of the game. Specify which player is expected to gain and how much.

3 I have two options for investing my money.
If I select Investment A, my wealth will be at \$50,000 with 60% probability, or at \$10,000 with 40% probability.
Investment B will transform my wealth to \$20,000.

My utility function is the exponential utility function.
I would accept a lottery with 50% chance of winning an amount of money and 50% chance of loosing half of this amount, as long as the amount that I could loose is smaller than \$6,000 (The maximum amount that I could win is \$12,000)

$$U(x) = 1 - \ell^{-x/R}$$

10 Which investment should I select?

4 You are contemplating two alternative uncertain investments, whose distributions for payoffs are as follows:

Net	Probabilities	
Payoff(\$)	Investment C	Investment D
50	1/3	1/4
100	1/3	1/2
150	1/3	1/4

2 a. Without calculating any figures, which investment is more risky and why?
6 b. If your preference (utility) function is U(x)=Ln(x), what are your Certainty Equivalent and Risk Premium in each investment

5 Suppose that we have the following alternatives and state of nature matrix:

	A1	A2	A3	A4	A5	A6
S1	10	4	3	8	7	4
S2	1	5	7	1	2	6
S3	2	4	8	2	7	4
S4	3	4	4	2	7	4

8 a Determine the optimal action under each of the following decision rule: Maximin, Maximax, Laplace (Assume equal probability for each state), Minimax Regret.

4 b. In the Hurwitz Rule, we use a coefficient of optimism, $0 < \alpha < 1$, where $\alpha=0$ is totally pessimistic, and $\alpha=1$ is totally optimistic. Determine the optimal actions for all values of α between 0 and 1. Use a graph to show your solution.

6 Alron Development is bidding against Basil Ventures for a project. Alron believes that Basil's bid could be as follows:
$6000 with a probability of 20%, $8000 with a probability of 50% or $12000 with a probability of 30%. It will cost Alron $6,000 to do the project.
Alron considers 6 alternatives for its bid: $5900, $6100, $7900, $8100, $11900, $12100.

6 a. Construct a payoff (profit) matrix for Alron Development

6 b. Determine Alron's bid according to the following decisions rules: Maximin, Maximax, Laplace, Minimax Regret.

7 An individual has to make two decisions within 5 minutes of each other, as follows:

- Decision 1: Choose A or B
  A - win $1 million with probability 1
  B - win $5 million with probability .10
  win $1 million with probability .89
  win 0 with probability .01

- Decision 2: Choose C or D
  C - win $1 million with probability .11
  win 0 with probability .89
  D - win $5 million with probability .10
  win 0 with probability .90

If the decision-maker prefers A over B, in Decision 1 and D over C in Decision 2. Does he create a contradiction / paradox in terms of his individual utilities?
10 Explain your answer, using decision trees, utilities and equations.

8 6 a. List the 3 main types of blocks to creativity and mention 2 sub-headings or 2 short sentences to each of them.

6 b. List 3 advantages and 3 disadvantages to Group Decision Making

9 Comment on the following statement:
For an effective group decision making and execution, it is important to include individuals with different / same personalities and different / same action profiles (In addition to their professional knowledge and experience)

6 Explain your answer, in 2-4 sentences.