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Decision Analysis
Course No. 2614

Final Exam
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This exam consists of four questions, of which you may choose three questions to answer. If you answer all four questions, please indicate which three you wish to have graded. If you do not do so, the <u>first</u> three answered questions will be graded.

The total time for this exam is 60 minutes. Each question is composed for approximately 20 minutes answering time. Accordingly, each question offers the possibility of obtaining 20 points. The importance of the sub-questions is indicated by the points that you can achieve. The maximum number of points that you can achieve in the exam is 60.

Admitted Aids: Pocket calculator; dictionary without handwritten notes.

Question 1:

Manager Victor S. wants to buy a portable computer. His choice has narrowed own to five technically equivalent machines. His final choice should satisfy two main objectives: "working time on battery power" and "weight of the computer."

a) Victor visits a store to get some further information. He tells the sales person: "A lighter weight is more important to me than a long battery lifetime." How can this statement be interpreted formally? Provide at least two alternative explanations. **(8)**

b) Victor wants to solve his decision problem using an additive value function. He, therefore, considers the individual value functions
   -   for battery power in a range of 0 to 8 hours, and
   -   for weight in a range of 0 to 6 kilograms.

   Suppose the value functions for the attributes are linear (which is not necessarily plausible). The worst outcomes are given the value 0 and the best outcomes the value 100. Now the weights of the attributes must be determined. Victor concludes that a computer with a weight of 2 kg and 4 hours of battery usage is just as good as a computer with a weight of 3 kg and 6 hours battery usage. Which weights can be derived from this statement? **(12)**

Question 2:

Uncle Euclid, an ancient Athenian entrepreneur, is anxious to start a new business. Three possibilities are available to him, and the success of each enterprise will depend on the volatile tastes of the consumers of Athens. In analyzing his decision problem, Euclid has classified the market conditions into three possible states, θ_1, θ_2, θ_3, and he assesses his profit (in monetary units) for each of the three enterprises, a_1, a_2, a_3, as:

	θ_1	θ_2	θ_3
a_1	5	0	13
a_2	6	7	7
a_3	2	4	9

To help him determine the future state of the market, Euclid may, at a price, consult the Delphi Oracle, who will tell him for certain which state will prevail. Calculate the maximum that Euclid would be prepared to pay the Oracle for this information if he makes his decision according to

a) the Hurwicz-rule with an optimism parameter of 2/3.   **(9)**
b) the minimal regret rule.   **(9)**
c) Explain why the Hurwicz decision maker is not willing to pay as much for Oracle as the minimal-regret decision maker.   **(2)**

Question 3:

a) A venture capitalist is thinking of financing two alternative ventures. One is a proposal to market a generic brand of a drug whose patent is to expire shortly. This would yield an expected profit of $100 000. The other project would require investing $10 000 in developing a commercial application of a gene-splicing technique. There is a 50% chance that the new technique will actually work, in which case the product could be marketed, requiring an additional investment of $90 000. With a 50% chance the new product will be successful, yielding an overall profit of $500 000. Based on the given information, determine the profit-maximizing decision of the venture capitalist, assuming that he is risk neutral. **(10)**

b) A mining company is carrying out a survey in a region of Western Australia. On the basis of preliminary results, the company's senior geologist estimates that there is a 50% probability that a particular mineral will be found in quantities that would justify commercial investment in the region. A further research method suggests that commercially viable quantities of the mineral will be found. It is estimated that this research gives a correct indication in 2 out of 3 cases. Revise the senior geologist's estimate of finding the mineral in the light of the research results. **(10)**

Question 4:

When the parents of Sonja and Boris sold their house in order to move to a smaller apartment in the city, they left behind several items for their children to divide (fairly) amongst each other: a bicycle, a piano, a toolbox, a computer, and a collection of stamps. The subjective valuations of all items by both children as well as the percentage shares of the complete estate are given in the following table:

	Item	Sonja %	Sonja €	Boris €	Boris %
1	Bicycle	38	2000	600	13
2	Piano	6	300	2000	44
3	Toolbox	12	600	400	8
4	Computer	38	2000	1000	22
5	Stamps	6	300	600	13
	Sum	100	5200	4600	100

a) Suppose that Sonja and Boris agree on applying the procedure "Divide and Choose". If Sonja is in the role of the Divider, but does not know Boris' assessment of the items, how can she divide the items to ensure for herself an envy-free share? **(4)**

b) Suppose that Sonja and Boris agree on applying the "Market Procedure". Who receives which items? How high is the transfer payment? How high is the final percentage value for each child? **(8)**

c) Suppose that Sonja and Boris agree on applying "Adjusted Winner". Who receives which items? Which item is to be divided? How high is the final percentage value for each child? **(8)**