ManSci

5072 Management II

Decision Theory

July 27, 2004

Last name: .... First name: .... Matriculation number: ....

Examination:	**Decision Theory**	**SS 2004**
Examiner:	**Prof. Dr. G. Wäscher**	

The following aids may be used:

- calculators

(non-programmable, without communicating and/or data processing functions)

- dictionaries

(without own remarks)

Number of examination questions: 5

Assignment # 1 (15 points)

The following table comprises the data of a decision problem with four alternatives (a_1, a_2, a_3, a_4) and four states of nature (s_1, s_2, s_3, s_4). Note that the entries represent costs, which the decision maker wants to minimize.

	s_1	s_2	s_3	s_4
a_1	20	30	10	50
a_2	30	20	30	30
a_3	10	40	20	20
a_4	10	0	30	40

a) What would be the alternatives to be chosen if an optimistic, or alternatively, a pessimistic approach would be applied? What recommendation(s) would result from the application of the LAPLACE- and the MiniMax-Regret-Rule, respectively?

b) Give formal definitions of the above-mentioned rules!

Assignment # 2 (10 points)

Let the following utility function be given for a decision maker:

$$u(r) = 0.4472 \cdot \sqrt{r} \quad , 0 \leq r \leq 5$$

(r: reward in TEURO). A lottery is offered to him, in which he receives 3 TEURO with a probability of 75%, and 1 TEURO with a probability of 25%, respectively.

What is the decision maker's Expected Reward, the Certainty Equivalent and the Risk Premium of this lottery?

Assignment # 3 (25 points)

Max wants to upgrade his computer with a new hard drive. The considered alternatives have a capacity ranging from 60 to 160 gigabyte, a price between 50 and 140 Euro, and a noise level (nl) while in operation between 38 and 44 decibel (db). Max's value functions for the different attributes have been determined as follows:

$$u_{capacity}(r_{capacity}) = \frac{r_{capacity} - 60}{100}, \quad u_{price}(r_{price}) = \frac{140 - r_{price}}{90}$$

r_{nl}	u_{nl}	r_{nl}	u_{nl}
38.0	1.00	41.5	0.22
38.5	0.83	42.0	0.17
39.0	0.69	42.5	0.12
39.5	0.56	43.0	0.07
40.0	0.46	43.5	0.04
40.5	0.37	44.0	0.00
41.0	0.29		

Max thinks that a hard drive with 80 gigabyte that comes at a price of 77 Euro is just as good as a hard drive with 130 gigabyte and a price of 104 Euro. He further believes that a hard drive with a capacity of 90 gigabyte and a work noise level of 40 db is just as attractive as a hard drive with 116 gigabyte and a work noise level of 43 db.

a) Use the given information to determine the scaling factors (weights) for Max's additive value function!

b) Which of the following hard drives will Max choose?

hard drive	capacity [gigabyte]	price [€]	noise level [db]
Seagate Barracuda ATA 7200.7	160	110	41.0
ExcelStor J360	60	55	38.0
Hitachi Deskstar 7k250	160	90	43.5

c) What is the price for the Samsung Spinpoint SV1604N (160 gigabyte, a work noise level of 38 db) for which Max no longer prefers this hard drive to the ExcelStor J360?

Assignment # 4 (20 points)

The management of a rock festival tries to determine the best way of advertising the event. Information about possible advertising media is given the following table:

media	number of persons reached by a single advertisement	cost per advertisement
radio	100,000	400 Euro
newspaper	50,000	160 Euro

The management of the rock festival considers the following goals:

Priority Level 1: At least 2 million people should be reached.

Priority Level 2: The number of newspaper advertisements should be at least 25.

Priority Level 3: Limit the total amount of money spent on advertising to 8000 Euro.

Priority Level 4: The number of newspaper advertisements should not exceed the number of radio advertisements by more than ten.

a) Formulate a goal-programming model of the problem!

b) Solve the problem graphically!

Assignment # 5 (30 points)

A publisher must decide if he publishes a manuscript submitted by an author. He knows that one out of five books of this author becomes a bestseller, the remaining ones are "lame ducks". The publication of the manuscript causes printing costs of 25,000 Euros, costs of warehousing and transportation add up to 10,000 Euros. If the book becomes a bestseller, then a revenue of 185,000 Euros will be achieved. Otherwise, the remaining copies of the book can only be sold at a very low price that just compensates the warehousing and transportation costs.

Additionally, the publisher considers to have the manuscript reviewed by an experienced editor. For 5,000 Euros the editor will provide a report which classifies the manuscript either as a bestseller or as a "lame duck". Regarding his former statements, the editor correctly identified a subsequent bestseller in 80% of all cases. In 10% of all cases the editor classified a manuscript wrongly as a bestseller, which later become a "lame duck".

a) Develop a decision tree for this problem!

b) Determine the optimal strategy of the publisher by using the rollback procedure under the assumption that the decision-maker is risk-neutral!