Otto-von-Guericke-University Magdeburg
Faculty of Economics and Management
- Management Science -
Prof. Dr. Gerhard Wäscher

Management II (5072)
Decision Theory
End-Term Test
July 25, 2006

Last name: ..... **First name:** ..... **Matriculation No.:** .....

Examination: Decision Theory
Examiner: Prof. Dr. G. Wäscher

General remarks:

1. Write your name and matriculation number on this cover sheet and on every other sheet that has been issued to you.
2. Leave a minimum of 4 cm as correction space on the outside margin of each page.
3. Make sure that you have a complete copy of the test. The test consists of **4 assignments**, all of which have to be dealt with. It is not permitted to remove the retaining clip; doing so will be treated as fraudulent behaviour.
4. Please write legibly and number the pages which have been used. For each assignment, put down your answers on a separate sheet. Only pens with permanent ink may be used, while correction pens or ink erasers are not permitted. Make sure that you don't write in red.
5. Always make clear how you have determined your solution (solution path). Isolated solutions without traceable origin will not be accepted.
6. The following aids may be used: writing utensils, non-programmable pocket calculators without communicating and/or data processing functions, dictionaries (without any added remarks only).

Assignment 1 (7 points)

Let a lottery being offered, in which you can either receive 10 EUROs with a probability of 81 % or nothing with a probability of 19 %. Max and Paul consider to participate in this lottery. Their utility functions for money are as follows:

$u_{Max}(r) = 3r^2 + 4 \quad , r \geq 0 ,$ (Max)

$u_{Paul}(r) = 6r^2 + 10 \quad , r \geq 0 .$ (Paul)

a) What is the Certainty Equivalent and the Risk Premium of this lottery for Max?
b) What is the Certainty Equivalent and the Risk Premium of this lottery for Paul?
c) What do you can conclude from the answers given under a) and b) ?

Assignment 2 (10 points)

John has invited the three "angels" Jill, Sabrina and Kelly for dinner to his house. From previous invitations he has developed the following probability distribution for the number of angels showing up:

- all three of them show up: 37.5 %
- (exactly) two angels show up: 25.0 %
- (exactly) one angel shows up: 25.0 %
- none shows up: 12.5 %

Now John must decide how many meals he should prepare. On the one hand, he does not want to prepare too many meals, because of the high costs of the ingredients. On the other hand, John will also regret not having prepared enough meals for his guests. John's preferences can be represented by the following utility function:

$u(x,y,z) = x - 2y - z^2 \quad , x, y, z \geq 0$

- x represents the number of 'angels' coming,
- y represents the number of 'angels' to whom no meal can be offered,
- z represents the number of unconsumed meals because too few angels showed up.

Note that each "angel" can only eat one meal. The meals cannot be split.

How many meals, expect for the one for himself, should John prepare?

Assignment 4 (12 points)

Indicate those statements which are **correct** by marking the respective box. Note that more than one answer may be correct. (One point subtracted for each incorrect answer - minimum number of points for the complete assignment is 0.)

1) The following table depicts the data of a decision problem under complete uncertainty with three alternatives (a_1, a_2, a_3) and four states of nature (s_1, s_2, s_3, s_4). Note that the entries represent **rewards**, which the decision maker wants to maximize.

	s_1	s_2	s_3	s_4
a_1	2	3	3	4
a_2	2	3	3	4
a_3	1	2	-2	2

(1a) ☐ a_1 dominates a_2 according to the state dominance principle

(1b) ☐ a_1 dominates a_2 according to the absolute dominance principle

(1c) ☐ a_1 dominates a_3 according to the state dominance principle

(1d) ☐ a_1 dominates a_3 according to the absolute dominance principle.

2) The following table depicts the data of a decision problem under risk with three alternatives (a_1, a_2, a_3) and four states of nature (s_1, s_2, s_3, s_4). Note that the entries represent **rewards**, which the decision maker wants to maximize.

	s_1 $p(s_1)=0.2$	s_2 $p(s_2)=0.3$	s_3 $p(s_3)=0.3$	s_4 $p(s_4)=0.2$
a_1	0	10	20	0
a_2	10	0	0	20
a_3	20	10	0	0

(2a) ☐ a_1 dominates a_2 according to the probability dominance principle

(2b) ☐ a_1 dominates a_3 according to the probability dominance principle

(2c) ☐ a_2 dominates a_1 according to the probability dominance principle

(2d) ☐ a_2 dominates a_3 according to the probability dominance principle

3) The following table depicts the data of a decision problem under complete uncertainty with three alternatives (a_1, a_2, a_3) 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	5	3	4	0
a_2	3	4	5	1
a_3	5	3	6	3

(3a) ☐ If the decision maker uses the MiniMax-Regret-Rule he will chose a_1

(3b) ☐ If the decision maker uses the MiniMax-Regret-Rule he will chose a_2

(3c) ☐ If the decision maker uses the MiniMax-Rule he will chose a_1

(3d) ☐ If the decision maker uses the MiniMin-Rule he will chose a_1.

4) The MiniMax-Regret Rule for decision making under complete uncertainty contradicts

(4a) ☐ MILNOR's Axiom of Independence from the Addition/Deletion of Alternatives

(4b) ☐ MILNOR's Axiom of Independence from the Addition/Deletion of Identical Columns

(4c) ☐ MILNOR's Axiom of Column Linearity.

5) If a decision maker acts according to the Sure-Thing Principle ...

	s_1	s_2	s_3	s_4
a_1	5	6	1	4
a_2	5	6	3	2

	s_1	s_2	s_3	s_4
a_3	5	6	3	6
a_4	5	6	5	4

	s_1	s_2	s_3	s_4
a_5	1	4	5	5
a_6	3	2	6	6

	s_1	s_2	s_3	s_4
a_7	2	6	1	4
a_8	2	6	3	2

(5a) ☐ ... and prefers a_2 to a_1 than he must also prefer a_4 to a_3

(5b) ☐ ... and prefers a_2 to a_1 than he must also prefer a_6 to a_5

(5c) ☐ ... and prefers a_2 to a_1 than he must also prefer a_8 to a_7.

Assignment 3 (16 points)

The owner of a record label, who can be considered as risk-neutral and whose objective is to maximize the expected profit, must decide whether or not to publish a new album of one of his artists. The owner knows that if he publishes the album now, the album will sell well with a probability of 0.4. Alternatively, he may also ask a market research firm to carry out a market survey in order to obtain more precise data of the potential sales of the album. The market research firm he intends to contact will only provide one of the following two results:

- the album will do well in the market
- the album will do badly in the market.

From previous contacts with the market research firm the owner of the record label knows that the forecasts of the market research firm are always 100 % correct.

If the album does well in the market, the owner expects the profits (excluding the cost of the survey) to be 100,000 EUROs. If the album does badly in the market, he expects a loss of 50,000 EUROs (excluding survey costs). The costs for the survey are 15,000 EUROs.

a) Represent the decision problem in a decision tree!
b) Represent the decision problem in a decision table!
c) Determine the optimal strategy from the decision tree of the owner by using the roll-back procedure!