



Management II (5072)

Decision Theory

February 22, 2005

Last name: First name: Matriculation No.:

Examination: Decision Theory

WS 2004/2005

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 **6 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 (5 points)

You intend to buy a new car (VW Golf) for your indecisive grandpa, who won't tell you which colour the car should have. However, he is willing to provide strict and consistent preferences between any pair of colours. The choice of colour is restricted to seven colours. You have already asked him seven questions and learnt that the following holds:

Black \succ Reflex Silver, Mojave Beige \succ Black, Blue Anthracite \succ Candy White,
Mojave Beige \succ Tornado Red, Candy White \succ Mojave Beige,
Tornado Red \succ Reflex Silver, Indigo Blue \succ Mojave Beige.

What is the next and last question you have to ask him in order to determine his choice of colour for the car?

Assignment # 2 (20 points)

Describe the different steps of the Mid-Value Splitting Technique for the determination of value functions.

Assignment # 3 (20 points)

A decision maker has to choose between two investment projects. All relevant information is given in the following table:

	states of nature			
	s ₁	s ₂	s ₃	s ₄
project a	20	30	0	10
project b	0	10	10	30
probabilities p(s _j)	0.1	0.3	0.2	0.4

- Plot the probability functions, the distribution functions and the risk-profiles for both projects!
- Is one of the projects dominated by the other one?

Assignment # 4 (15 points)

A firm considers three investment alternatives (a_1, a_2, a_3). The following payoff table depicts the corresponding profits (in 1,000 \$) and the probabilities associated with the relevant states of nature (development of the economy):

	development of the economy		
investment alternatives	up (s_1)	stable (s_2)	down (s_3)
a_1	100	25	0
a_2	75	50	25
a_3	50	50	50
probabilities $p(s_j)$	0.40	0.30	0.30

- a) Using the expected value approach, which decision is to be preferred?
- b) Consider two decision makers A and B, each of them wanting to identify the alternative which suits their individual preferences "best" by means of the expected utility approach. As a consultant who tries to support them, you confront them with two options, namely a certain profit on one hand and a lottery on the other hand, which gives them a profit of 100,000 \$ with probability p and 0 \$ with probability $(1-p)$. One after another, you ask A and B to specify their individual indifference probabilities p for different potential values of the certain profit, i.e. the values for p which they are indifferent between the lottery and the certain profit. The answers of A and B can be seen from the following table:

	indifference probabilities (p)	
certain profit	decision maker A	decision maker B
75,000 \$	0.80	0.60
50,000 \$	0.60	0.30
25,000 \$	0.30	0.15

Find the most preferred decision for each decision maker using the expected utility approach!

- c) Argue why decision makers A and B do not select the same decision alternative.

Assignment # 5 (10 points)

Name three of Milnor's Axioms and describe their meaning briefly. You don't need to give numerical examples!

Assignment # 6 (30 points)

A police patrol has to decide whether or not they should take a driver to a test, in which the level of alcohol in his blood can be determined exactly (field sobriety test). Because of the country's tight budgetary position, the policemen are obliged to take the costs resulting from their decision into account, which are 50 Euro for a single field sobriety test. If the driver's blood alcohol level exceeds 0.5 (per thousand), he has to pay a fine of 250 Euro.

Apart from the field sobriety test, the policemen can also use a breathalyzer test, which costs 5 Euro only. However, it has to be taken into consideration that there's a chance of 5% that the test will be positive although the driver's blood alcohol level does not exceed 0.5; furthermore, the breathalyzer test will only be positive in 90% of all cases where the blood alcohol level is higher than 0.5. Consequently, a positive result from the breathalyzer test is never sufficient for a legal prosecution, and, therefore, is always to be succeeded by a field sobriety test.

The driver's behaviour gives the policemen reasons to assume that the driver's blood alcohol level is higher than 0.5 with a 60% chance. What decision should be made by the policemen if they wish to maximize the expected value associated with their actions?

- a) Represent the decision problem into by a decision tree!
- b) Find the optimal strategy for the policemen by application of the roll-back method!