

Examination: 11057 Decision Analysis

Summer Semester 2010

Examiner: Dr. Rainer Kleber

Allowed Aids:

You are allowed to use a pocket calculator, subject to the examination office policy concerning them. You are also allowed to use an English (or English to X / X to English where X is any other language) dictionary (book, not electronic) without any handwritten entries.

Instructions:

Ensure your name and matriculation number is correctly entered on the examination booklet and use the booklet to record your answers legibly (readably). You are requested to answer all of the questions. The examination has 120 points, and points for each of the questions are provided in brackets after each question. With respect to rounding, decimal places should be kept until the final answer, and then rounded to an appropriate number of decimal places. **Show all calculations.**

Good Luck!**Questions:**

- (1) What are the four elements of decision problems? Name the elements and give an example for the case of a farmer cultivating nearly ripe fruits in his orchards! (6)
- (2) What are the two different kinds of objectives? How exactly are they organized (use the words network, hierarchies, and levels)? (4)
- (3) When using influence diagrams to structure decision problems there are four types of nodes. How does each type look like and for what is it used? (8)
- (4) Johnson Marketing is interested in producing and selling an innovative new food processor. The decision they face is the typical "make or buy" decision often faced by manufacturers. On the one hand, Johnson could produce the processor itself ("make"). Cost are uncertain with estimates given as follows:

Cost per unit (\$)	Chance (%)
35.00	25
42.50	25
45.00	37
49.00	13

The company also could have the machine made by a subcontractor ("buy") which faces similar uncertainties regarding the cost. These are estimated as follows:

Cost per unit (\$)	Chance (%)
37.00	10
43.00	40
46.00	30
50.00	20

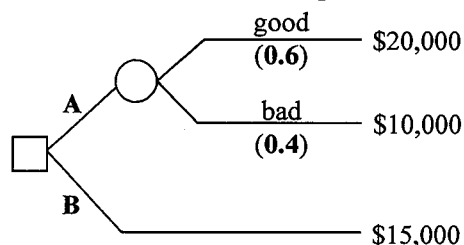
- a. If Johnson Marketing wants to minimize its expected cost of production in this case, should it "make" or "buy"? (6)
- b. Construct cumulative risk profiles for both alternatives. Can you draw any conclusions from that? (10)

- (5) Consider the payoff table as shown below, in which the entries are net dollar returns. Assume that this is a decision under uncertainty.

	States of Nature		
Decision	S1	S2	S3
A	10	-30	40
B	20	-10	20
C	15	10	25

What is the optimal decision if the following criterion is used?

- Maximax (2)
 - Maximin (2)
 - Minimax Regret (4)
 - Hurwics with the Coefficient of Optimism equal to the Coefficient of Pessimism (4)
 - Laplace (4)
- (6) In lecture, we discussed four phases of the creative process according to Wallas (1962). **Name and describe** what happens in each of the four phases. (4)
- (7) In lecture, we discussed different blocks to creativity. **Name four kinds of Framing and perceptual blocks** and describe two of them! (8)
- (8) Vanessa is preparing for her DA examination. She estimates her chances of getting a good grade at 60%. Then after talking to other students, she realizes that of those students who obtained good grades, 80% also did perform well in business statistics. On the other hand, of those who were not pleased with their grade, 30% did do well in business statistics. If Vanessa did do well in business statistics, what are her chances of receiving a good grade in DA? What if not? (10)
- (9) For two events **A** and **B**, the following probabilities are known: $P(A) = 0.42$, $P(B | A) = 0.66$, and $P(B | \bar{A}) = 0.25$. Find the following probabilities:
- $P(\bar{A})$ (1)
 - $P(A \cap B)$ (2)
 - $P(B)$ (2)
 - $P(\bar{B})$ (1)
 - $P(A | B)$ (2)
- (10) In quality control the number of defective products often is estimated by using the Binomial distribution. Explain this by checking the requirements for applying the Binomial Distribution. (4)
- (11) A risk neutral decision maker is faced with the problem shown below.



A test is available that will provide information about possible outcomes if alternative **A** chosen. What is the maximum possible value of the test? (6)

- (12) Name all 7 axioms which, if hold in a particular situation, yield decisions consistent with maximizing the expected utility. Shortly explain 3 of the mentioned axioms. (10)

- (13) An investor deliberates investing her whole wealth of \$5,000 in an uncertain asset. After a year the asset will return a net gain of \$10,000 with probability 0.3, a zero net gain with probability 0.4, and a net loss of 3000 with probability 0.3. As an alternative she could keep the money on her savings account at an interest rate of 10%. The investor decides based on her logarithmic utility function of $U(x) = \ln(x)$, where U represents her utility and x her wealth.
- Would she invest? (4)
 - In what range could the interest rate vary without changing her decision in a? (3)
 - What type of risk attitude is assumed when using a logarithmic utility? (1)
- (14) Another decision maker with an exponential utility function $U(x) = 1 - e^{-x/a}$ shows a risk tolerance of \$2000.
- Find the expected utility for an investment that has the following payoff distribution:
 $P(-\$500) = 0.2$ $P(\$500) = .5$ $P(\$1000) = .3$ (6)
 - Find the certainty equivalent and the risk premium! (6)