Examination: 11057 Decision Analysis Winter Semester 2011/12

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:

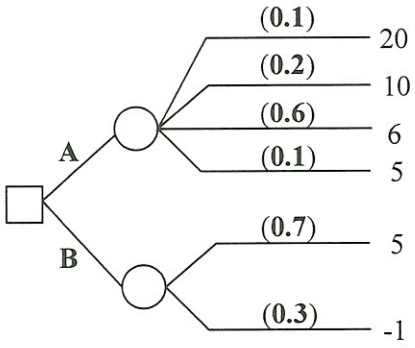
(1) Why are some decisions hard to make? (Hint: Name and shortly explain **four** sources.) **(8)**

(2) Name all four elements of decision problems. **(4)**

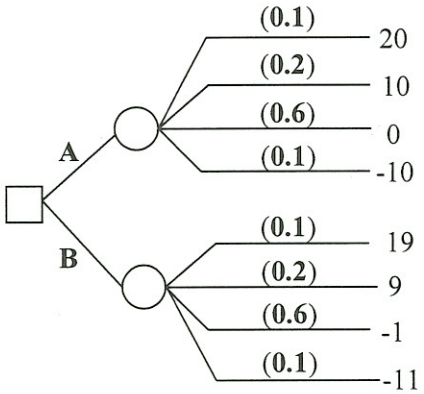
(3) When using influence diagrams to structure decision problems there are four types of nodes. How does each type look like and for what purpose is it used? **(8)**

(4) Consider the following two decision trees. For each tree, does one alternative dominate the other? If so, which of the two dominance criteria applies? **(4)**

Tree 1:



Tree 2:



(5) Consider the payoff table as shown below, in which the entries are net dollar returns. Assume that this is a decision under uncertainty. **(16)**

	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?

a. Maximax
b. Maximin
c. Minimax Regret
d. Hurwics with the Coefficient of Optimism equal to the Coefficient of Pessimism
e. Laplace

(6) 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: **(10)**

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"?
b. Construct cumulative risk profiles for both alternatives. Can you draw any conclusions from that?

(7) What is the meaning when speaking of *Fluent* and *Flexible Thinking*? What is the difference between both? **(4)**

(8) For two events **A** and **B**, the following probabilities are known: $P(A) = 0.42$, $P(B \mid A) = 0.66$, and $P(B \mid \overline{A}) = 0.25$. Find the following probabilities: **(8)**

a. $P(\overline{A})$ **(1)**
b. $P(A \cap B)$ **(2)**
c. $P(B)$ **(2)**
d. $P(\overline{B})$ **(1)**
e. $P(A \mid B)$ **(2)**

(9) In quality control the number of defective products often is estimated by using the Binomial distribution. Explain this by checking validity of the requirements for applying the Binomial Distribution. **(4)**

(10) Walter's dog show is scheduled to appear in Magdeburg on May 16. The profits obtained are heavily dependent on the weather. In particular, if the weather is rainy, the show loses \$15,000, and if sunny the show makes a profit of \$10,000. (It will be either rainy or sunny.) Since ticket sales start at the beginning of March, Walter can still decide to cancel the show, but if he does he loses a \$1,000 deposit he paid when accepting the date. Historical data reveal that there is a 25% probability that it will rain on May 16. **(20)**

a. Which decision should Walter make to maximize his expected net dollar return?
b. What is the expected value of perfect information (EVPI) in this situation? Drawing a decision tree is not required.
c. Walter has the option to purchase a forecast from Stella's Weather Wonder. Stella's accuracy varies. On those occasions when it has rained, she has been correct 90% of the time. On the other hand, when it has been sunny she was right only 80% of the time. Draw the corresponding decision tree and calculate the expected value of imperfect information (EVII).
d. How much should Walter be willing to pay for Stella's Forecast?

(11) Suppose you are indifferent between a sure payment of 60 and a lottery with a probability of $p = 0.3$ of winning 100 and a probability of 0.7 of winning nothing. **(6)**

a. Which kind of risk preference do you show? Explain!
b. Sketch three different utility functions for wealth showing different risk attitudes.

(12) An investor deliberates investing in an uncertain asset. The asset will return a net gain of 5000 with probability 0.3, a zero net gain with probability 0.4, and a net loss of 2500 with probability 0.3. The investor decides based on her logarithmic utility function of $\mathbf{U(x) = \ln(x)}$, where U represents her utility and x her wealth. **(12)**

a. If the investor currently has \$3,000 in wealth, would she invest?
b. If the investor several years later now has \$10,000 in wealth, would she invest?
c. What is the specific name of this phenomenon?

(13) A car driver with an exponential utility function $\mathbf{U(x) = 1 - e^{-x/10000}}$ faces the following problem. He is a good driver but with a probability of 2% he might damage his car during the next year. Repairing it would reduce his initial wealth of \$8,000 by (in the average) \$5,000. **(12)**

a. What is the expected monetary value and expected utility of this "gamble"?
b. What is the certainty equivalent and risk premium for the gamble? Would the driver buy insurance for \$40 per year?

(14) A decision maker is assessing weights for three attributes (A, B, and C) using the swing-weight method. When he images swinging the attributes from worst to best, he concludes that his improvement in satisfaction from Attribute A is 60% of the improvement from swinging Attribute B. Attribute C provides 40% of the improvement from swinging Attribute B. Calculate k_A, k_B, and k_C. **(4)**