Examination: 11057 Decision Analysis Summer Semester 2011

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 two different kinds of objectives? How are they organized exactly (use the words network, hierarchies, and levels)? **(6)**

(2) A young decision making graduate preparing for an interview has just purchased a new suit for 300€. On the way out the door, the decision maker considers buying an umbrella for 20€. With the umbrella on hand, the suit will be protected in the event of rain. Without the umbrella, the suit would be ruined if it rains. On the other hand, if it does not rain, carrying the umbrella is an unnecessary inconvenience.

a. Construct an influence diagram for this situation. **(4)**
b. Draw a decision tree for this situation. **(4)**
c. Before deciding, the decision maker considers listening to the weather forecast on the radio. Draw an influence diagram that takes into account the weather forecast. **(2)**
d. What is the objective of the *clarity test*? Does your answer to b. pass this test and what should be changed if not? **(2)**

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

	States of Nature		
Decisions	S1	S2	S3
A	10	14	16
B	12	12	12
C	6	18	2

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

a. Maximax **(2)**
b. Maximin **(2)**
c. Minimax Regret **(4)**
d. Laplace? **(4)**
e. Which of the above criteria would be used by a very optimistic decision maker, which one by a very pessimistic one? **(2)**
f. What is meant when referring to "uncertainty" in this context? **(2)**

(4) The international coffee store Farbucks needs to decide in August how many holiday-edition coffee mugs to order. Because mugs are dated, those that are unsold by January 15 are considered a loss. These premium mugs are sold for $25 and cost $8 each. Farbucks is uncertain about the demand. They believe that there is a 70% chance that demand is 10,000 mugs and a 30% chance that demand is 20,000.

a. Build and solve a decision tree to decide whether to order 15,000 or 18,000 mugs. **(6)**
b. Perform a sensitivity analysis on the probability that Farbucks will sell 10,000 mugs. **(6)**
c. What is the fundamental question that sensitivity analysis answers? **(2)**

(5) Francis Hall at Hall's Printing in Philadelphia must decide to either accept a contract for a governmental printing job or to fly to Los Angeles to bid on a brochure. Capacity constraints prohibit him from doing both jobs, and he must decide on the government contract before the bidding process starts. He estimates the payoff table in terms of net dollars as shown in the table below:

	States of Nature	
Decision	Do not get brochure job	Get brochure job
Accept government contract	100	100
Reject government contract	-100	400

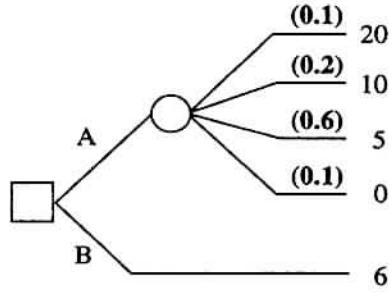
a. Let P(J) be the probability that he gets the brochure job. Which decision maximizes his expected net dollar return, if P(J)=0.5? **(4)**
b. For which probabilities of P(J) should Francis decide to go to LA and for which probability of P(J) should he take the government job? **(4)**

(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 and describe the four kinds of **value-based blocks**. **(8)**

(8) In capacity planning for call centers the number of incoming calls per minute is often modeled by using the **Poisson Distribution**. Explain this by checking the validity of the assumptions of the Poisson Distribution. **(6)**

(9) Calculate the EVPI for the decision tree shown below. The objective is to maximize the EMV. **(8)**



(10) Name all **7 axioms** which, if hold in a particular situation, yield decisions consistent with maximizing the **expected utility**. **(7)**

(11) A decision maker with an exponential utility function $\mathbf{U(x) = 1 - e^{-x/a}}$ shows a risk tolerance of \$1000.

a. Find the expected utility for an investment that has the following final wealth distribution:
P(-\$500) = 0.2 P(\$500) = 0.5 P(\$1000) = 0.3 **(4)**

b. Find the certainty equivalent and the risk premium! **(6)**

c. Does the risk premium change when adding \$1000 to the initial wealth of the investor and how? How do we call such behaviour? **(3)**

(12) Vanessa is preparing for her DA examination. She estimates her chances of getting a good grade at 60%. 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 received a good grade in business statistics, what are her chances of receiving a good grade in DA? What are her chances if she did not perform well? **(8)**

(13) 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:

a. $P(\overline{A})$ **(2)**

b. $P(B)$ **(2)**

c. $P(A \mid B)$ **(2)**

(14) An undergraduate student evaluating weather outcomes for the upcoming end-of-semester party has concluded that a sunny day would be three times as good as a cloudy day, and a cloudy day would be four times as good as a rainy day. Use these assessments to calculate utilities that range from 0 to 1 for sunny, cloudy, and rainy days. **(4)**