Examination: 11057   Decision Analysis   Summer Semester 2009

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. You may attempt all of the questions. The examination has 120 points, and points for each of the questions are provided 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 element and give an example for the orchard case (a farmer cultivates nearly ripe fruits in his orchards). **(4)**

(2)   Suppose you are planning a party after your last (successful) examination. You would like to have a very enjoyable outdoor barbecue being only possible if the sun is shining. If it rains you could drop the party (terrible) or stay inside (still o.k. but not as good as being outside). Naturally, you consult the weather forecast, which will be available at the time you decide upon whether at all and what kind of party to have.
   a.   Construct an influence diagram for this problem. **(4)**
   b.   Draw a decision tree for this problem. **(4)**
   c.   What is the objective of the *clarity test*? Does your answer to **a.** pass this test and if not, what should be changed? **(4)**

(3)   Consider the following decision tree:
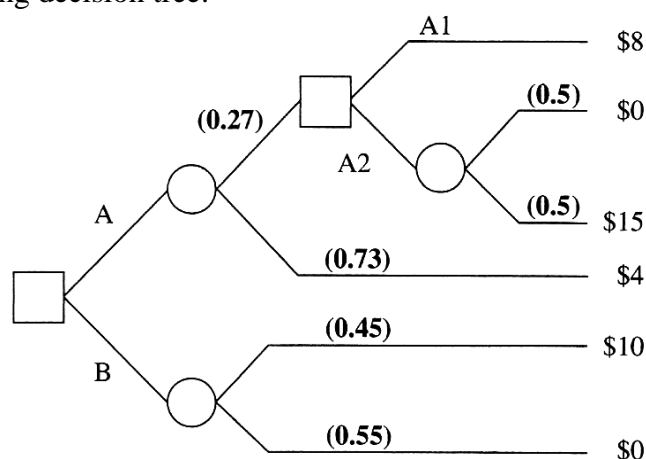
   a.   Solve the decision tree and give the optimal sequential strategy. **(2)**
   b.   Create cumulative risk profiles for all possible strategies. Plot all profiles in one graph. **(14)**
   c.   Is one strategy stochastically dominated? Explain. **(2)**
   d.   Explain why deterministic dominance is a special case of stochastic dominance. **(2)**

(4)   In lecture, we discussed different blocks to creativity. Name and describe the four kinds of **value-based blocks**. **(8)**

(5) 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 of the demand. They believe that there is a 70% chance to sell 10,000 mugs and a 30% chance that they will sell 20,000.
 a. Build and solve a decision tree to determine 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)**

(6) **Brainstorming** is an effective method for quickly generating many ideas. Name the basic rules for a brainstorming session (Hint: there are four of them). **(4)**

(7) In order to model the monthly demand for spare parts a **Poisson distribution** is commonly assumed. Explain this by checking the requirements for applying a Poisson distribution. **(4)**

(8) Julie is preparing for her DA examination. Before the examination, she estimates her chances of getting a good grade at 70%. Then, after talking to other students, she realizes that of those students who obtained good grades, 90% had a good feeling after the examination. On the other hand, of those who were not pleased with their grade, 40% said they had a good feeling. If Julie has a good feeling after the examination, what are her chances of receiving a good grade? **(8)**

(9) What are *Reference lotteries* used for? Explain the procedure by using an example decision tree. **(6)**

(10) A greeting card shop makes cards that are supposed to fit into 6-inch envelopes. Since the paper cutter is not perfect, the length of a cut card is triangularly distributed with a minimum of 5.6 inch, a maximum of 6.0 inch, and a mode (where the probability density function attains its maximum value) of 5.8 inch. If a card is longer than 5.9 inch, it will not fit into the envelope. What is the probability that a card will not fit into a 6-inch envelope? **(6)**

(11) Drilling-Oil-Trustworthy Company (DOTcom) owns a piece of land they believe to have oil underground. Actually, there is only a 5% chance that they might strike oil when drilling, but the payoff is $200,000. It costs $6,000 to drill. The alternative is not to drill at all, in which case profit is zero.
 a. Draw a decision tree to represent the problem and solve it. Should DOTcom drill? **(4)**
 b. DOTcom considers consulting an expert. What would be the expert's maximum acceptable charge if her prediction is always right? **(4)**
 c. Unfortunately, the expert is not perfect. If there is oil, the conditional probability is 90% that she will say prospects are good. If there is no oil, she will say poor with probability 80%. What maximum charge for the expert's information should DOTcom accept? **(8)**

(12) Sketch a Risk-prone utility function for wealth. **(2)**

(13) Another decision maker with an exponential utility function $U(x) = 1 - e^{-x/a}$ shows a risk tolerance of $800.
 a. Find the expected utility for an investment that has the following payoff distribution:
   P(-$200) = 0,1   P($400)=0,4   P($800) = 0,5   **(6)**
 b. Find the certainty equivalent and the risk premium. **(6)**

(14) Returning to your upcoming party after your last examination from question 2, you think that sunny weather would be three times as good as a cloudy day, and a cloudy day would be twice as good as a rainy day. Use these assessments to calculate utilities that range from 0 to 1 for sunny, rainy, and cloudy days. **(4)**