Examination: 11057   Decision Analysis   Winter Semester 2008/9

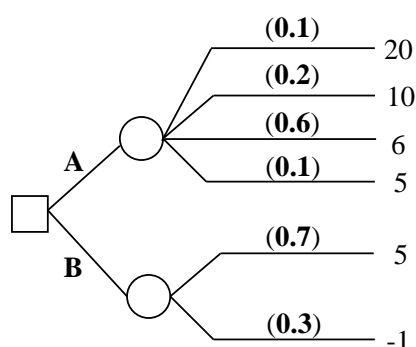Examiner: Dr. Rainer Kleber

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 reasons that make decisions hard? (Hint: there are four sources) **(4)**

(2)   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)**

(3)   What are the two different kinds of objectives? How exactly are they organized (use the words networks, hierarchies, and levels)? **(4)**

(4)   Consider the following two decision trees. Does one alternative dominate the other? If so, which of the two dominance criteria applies? **(4)**
Tree 1:   **Tree 2:**
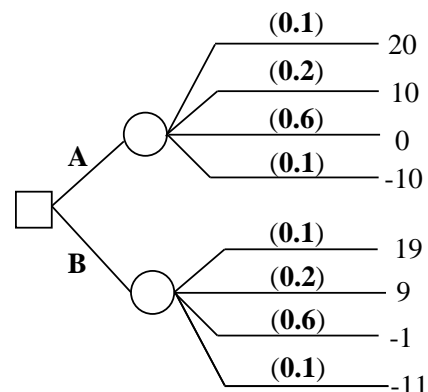
(5)   In lecture, we discussed four phases of the creative process according to Wallas (1926). Name and describe what happens in each of the four phases. **(4)**

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

(7)   James Kinnear, head of Texaco, made a deal with Gordon Getty on acquiring Getty Oil. Unfortunately, Getty already signed a contract with Pennzoil, which subsequently successfully sued Texaco, being awarded $6B. James must now decide on whether to pay the full amount awarded to Pennzoil, to try his luck at the final court, or to offer Pennzoil $2B (a fair amount he thinks) in order to settle the case.

At the final court he could either win (yielding a settlement of $0) or loose (no change in the initial amount). Both outcomes are equally likely. There is a 20% chance that Pennzoil will agree to the offered settlement. If they don't, James again can decide upon whether to pay the full amount or go to the final court. Suppose, James is risk neutral. **(14)**

(a)   Formulate a decision tree including all information.
(b)   Solve the decision tree. Give the complete strategy for this problem.
(c)   A detail left out so far is the bankruptcy option. James does not like to loose his job, but when filing for bankruptcy, Texaco would only loose about $2.5B. How would this affect the optimal strategy?

(8)   Sweet Milk Inc. is considering whether to enter the market for flavoured butter. This market consists out of two segments: *Premium* and *Regular*. The profit π of this project depends on uncertain total demand d, the product mix k (*Premium* proportion of total demand), and fixed cost F for building up production capacity such that $\pi = (3k + 1(1 - k)) \cdot d - F$. The following table provides base case, minimum and maximum values for the uncertain total demand, product mix and fixed cost.

	Min	Base	Max
Total demand d	40	100	120
Product mix k	0.3	0.5	0.7
Fixed cost F	80	100	120

Construct a tornado diagram including all three variables **(12)**

(9)   When eliciting expert opinion, one should follow 7 steps of the so-called *Protocol for expert assessment*. Name and explain briefly the 7 steps. **(14)**

(10) Forecasting future demand is a typical application for *regression* analysis. Here, time is the independent variable on which demand is assumed to depend linearly. Monthly demand over the last twelve months can be seen from the table below.

Month	Demand	Month	Demand
1	95	7	177
2	133	8	174
3	111	9	189
4	141	10	210
5	157	11	203
6	168	12	222

Your first calculations with Excel yield for the demand an average value of 165 with variance 1417. The average month is 6.5 with variance 11.92. Finally, you calculated the Covariance of Month and Demand yielding 125.83. **(10)**

(a)   Which would be your demand forecast for Month 13?
(b)   Would you use this procedure if you intend to forecast demand for the next three years? Give a short explanation.

(11) Sketch a typical utility function for monetary gains and losses. **(2)**

(12) Which theoretical probability distribution would be likely supposed if we are dealing with the question whether customers prefer one product to another? Chose the best answer. **(1)**
   a. Normal
   b. Poisson
   c. Exponential
   d. Binomial
   e. None of the above but:

(13) Which theoretical probability distribution would be likely supposed if we were measuring the time between breakdowns of a machine? Chose the best answer. **(1)**
   a. Normal
   b. Poisson
   c. Exponential
   d. Binomial
   e. None of the above but:

(14) A risk neutral decision maker is faced with the problem shown below.
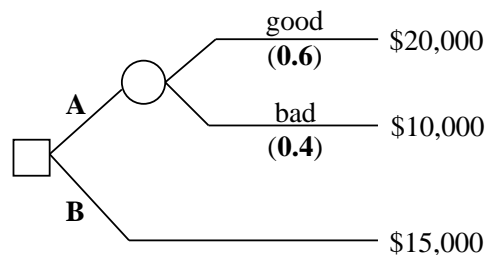
A test is available that will provide information about possible outcomes if alternative **A** chosen. Prior results of the test indicate that when outcome was good the test indicated "good" 90% of the time. Given the outcome was bad, the test predicted "bad" 40% of the time. What is the value of the information of the test? **(14)**

(15) 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 $U(x) = \ln(x)$, 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?

(16) A car driver with an exponential utility function $U(x) = 1 - e^{-x/10000}$ 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?

(17) 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)**