Intelligent Autonomous Agents and Cognitive Robotics
Exercise Sheet 8

1. Consider the following three-state, four-decision problem with the following payoff table:

	S1	S2	S3
D1	+100 000	+40 000	-60 000
D2	+50 000	+20 000	-30 000
D3	+20 000	+20 000	-10 000
D4	+40 000	+20 000	-60 000

the probabilities for the three states are P(S1) =0.5 P(S2)=0.3 P(S3)=0.2

Suppose you have the following utilities for two decision makers.

Amount	Decision Maker I	Decision Maker II
$100,000	100	100
$50,000	94	58
$40,000	90	50
$20,000	80	35
-$10,000	60	18
-$30,000	40	10
-$60,000	0	0

Compute the expected utilities for both decision makers.
Agents are trying to find always the best action in decision making. In some situation not all values for the evidence variables are known.
How much worth is the decision problem to each of the decision makers?

2. How can we implement the utility values in a multi-attribute problem?

3. Consider a student who has the choice to buy or not buy a textbook for a course. We'll model this as a decision problem with one Boolean decision node, B. indicating whether the agent chooses to buy the book, and two Boolean chance nodes, M, indicating whether the student has mastered the material in the book, and P, indicating whether the student passes the course. Of course, there is also a utility node, U. A certain student, Sam, has an additive utility function: 0 for not buying the book and -$100 for buying it; and $2000 for passing the course and 0 for not passing. Sam's conditional probability estimates are as follows:

   $P(p|b,m) = 0.9$ $P(m|b)=0.9$
   $P(p|b,\neg m)=0.5$ $P(m|\neg b)=0,7$
   $P(p|\neg b,m)=0.8$
   $P(p|\neg b,\neg m)=0.3$

   You might think that P would be independent of B given M, But this course has an open-book final—so having the book helps.

   a. Draw the decision network for this problem.
   b. Compute the expected utility of buying the book and of not buying it.
   c. What should Sam do?

4. In the lecture we developed how to determine the EU of a decision having no additional information and how the determine the EU by adding more information links. This leads to the situation where an agent has to find out whether to buy or not buy new information. How can the value of information be computed in terms of MEUs?

5. Suppose an investment agent wants to make an investment into only one of two companies: Mercedes, Hauni. Further suppose that the economy has a 50% chance of increasing, a 30% chance of staying even, and a 20% chance of decreasing. If the economy increases the Mercedes investment will earn $1500 and Hauni will earn $900. If the economy stays even the Mercedes investment will earn $300 and the Hauni investment will earn $600. If the economy decreases the Mercedes investment will lose $800 and Hauni will lose $200.

   a. Draw a decision network.

   b. Compute how much the agent is willing to pay for the information of the market behavior?