**Kennissystemen Exam**
March 25, 2008
*8:45 – 11:30*

This exam consists of 3 assignments on 2 pages.

Credits:

| 1a | 1b | 1c | 1d | 1e | 2a | 2b | 2c | 2d | 2e | 2f | 3a | 3b | 3c | 3d | 3e | 3f | 3g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 5 | 2 | 4 | 6 | 3 | 5 | 4 | 3 | 4 | 5 | 5 | 3 | 6 | 2 | 4 | 4 | 5 |

Total credits = 74

Read all questions carefully and make sure that you answer all elements of the questions (for example, do not forget to give an explanation or an example if asked for it). Good luck!

## Assignment 1: Knowledge representation

**a)** Which of the following marks are symbols according to the definition in the book. Explain you answer.
1) ⊗
2) ℨ
3) ♠
4) @
5) L

**b)** What does the *physical symbol hypothesis* say and why is this hypothesis relevant for knowledge systems?

The basic structure of a knowledge-based system consists of two components, apart from the user interface.

**c)** When we consider a rule-based system, in which of those two components reside the rules?

It is both an advantage as a disadvantage of rule-based systems that it is possible to express different types of knowledge in the same format.

**d)** Explain why this is both an advantage and a disadvantage.

**e)** Describe three types of knowledge that can be expressed in rules and give an example of each of them.

## Assignment 2: Medical registration system

A system is being developed for a hospital in which doctors can register the problems of the patients and the performed actions (i.e. treatments). The system can perform several functions based in this data. One of the goals of the system is to categorize patients in groups, such as "hearth-patients", "infectious patients" and "patients in a life-threatening situation".

**a)** What is the name of the (standard) task that this system performs?

**b)** Which of the following facts in the system could *in principle* be part of the data-space of this task? Explain your answer briefly.
1) number of admitted patients
2) average hearth-rate of a patient in the last hour
3) symptoms of a hearth-attack

4) diagnosis of a patient
5) primary doctor of a patient
6) names of bacteria that can cause an infection
7) age of the patient

**c)** Which criterion should the developers of the system use for the solution "patients in a life-threatening situation":
1) *conservative*,
2) *positive coverage*,
3) *complete explanation*, or
4) *probability threshold.*

Explain why.

Another task of the system is to produce the roster for the nurses, taking their working hours, expertises, and the problems of the patients. The roster is assigned in slots of 4 hours.

**d)** Which (standard) task performs the system in this scenario?

**e)** Would you choose for a continuous or discrete time representation? Explain your answer.

De law prescribes that a shift has a maximal length, for example 12 hours.

**f)** What is the name of the sub-model in which this knowledge belongs? Also give another example of knowledge that could be described in this sub-model.

**Assignment 3: Traffic-management**

Suppose that the government wants to develop a system that should help to prevent traffic jams. The task that this system performs is diagnosis: it is concluded that there is a jam, the cause is being investigated, and an attempt to a repair is being undertaken, e.g. by suggesting alternative routes.

**a)** Describe and explain which advantages of applying a knowledge-based system are relevant in this case.

**b)** Two types of causes are being distinguished for diagnosis. In the case of a traffic-jam a possible cause is "snow". Which type of cause is this?

**c)** What describes the system model for a diagnosis task? Give two examples of knowledge that could be part of the system model for this application.

In this system, the capacity of a road is an important factor. This is calculated from the data in the system about the number of lanes of a road and the maximum speed.

**d)** What is the name that is used for knowledge that is not stored directly, but first has to be calculated?

**e)** Which factors should you consider (balance) to decide whether or not you store knowledge in this way?

Vague concepts such as "drizzle", "heavy rain" and "low sun" play a role in this domain. These concepts can be described using *fuzzy sets*.

**f)** Describe for all three concepts mentioned above what would be on the x-axis and what on the y-axis if the concepts are represented using a *fuzzy set* diagram.

**g)** Is it possible to derive the function for the vague concept "heavy rain and low sun" from the functions of the above mentioned concepts? If yes, describe or draw this should be done. If no, explain why not.

**End of exam.**