Kunstmatige Intelligentie Divisie Wiskunde en Informatica Faculteit der Exacte Wetenschappen	**Exam** **KNOWLEDGE SYSTEMS**
Vrije Universiteit Amsterdam	April 18, 2000, 11.45 – 13.30 hrs

Marks:

Question	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b
max. points	8	7	9	6	7	8	8	7	9	6	9	6

Grade = (total of points + 10)/10.

Question 1: Basis

a) Mention 4 (or else as many as possible) conditions which (ideally) have to be satisfied to design a knowledge system for performing a particular task.

b) Mention 3 (or else as many as possible) dangers/problems/limitations of the use of knowledge systems.

Question 2: Production rules

a) Mention 3 (or else as many as possible) advantages of the use of (production) rules for knowledge systems.

b) Explain the difference between a production rule and a (material) implication from logic.

Question 3: Uncertainty

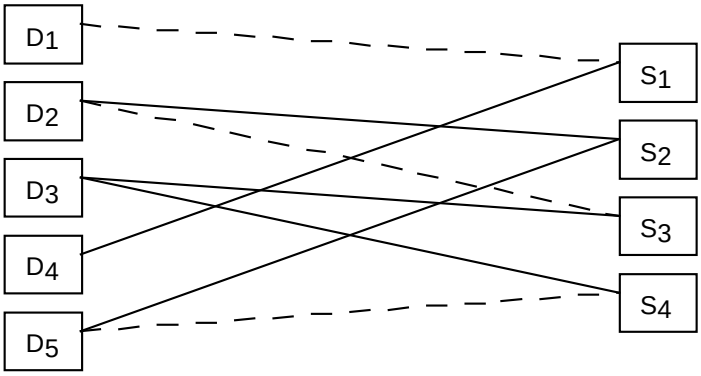
In the control room of a nuclear power plant, information about the state of a particular valve is reveived from a not completely reliable sensor. If according to the sensor the valve is open (*O: the valve is open*), then a red indication light is on (*R: a red indication light is on*), and if according to the sensor the valve is closed (*C: the valve is closed*), then a green indication light is on (*G: a green indication light is on*). Assume that always exactly one of the two indication lights is on. Further assume that the prior probability that the valve is open equals 1 in a thousand ($P(O) = 0.001$), and that the reliability of the sensor is given by $P(R \mid D) = 0.009$ and $P(G \mid O) = 0.001$.

a) Show that the prior probability that the red indication right is on 0.00999. [Hint: use the law $P(A) = P(A|B)P(B) + P(A|{\sim}B)P({\sim}B)$.]

b) Compute $P(O \mid R)$, the probability that the valve is open given that the red indication light is on. [Hint: use Bayes' rule.]

Question 4: Classification

Consider the following simple classification model:



a) For the data vector ⟨ 0 ? 1 ? 0 ⟩, which classes are consistent, inconsistent, and/or matching?

b) Are there data vectors which allow no solutions? If yes, give an example of such a data vector. If no, explain why such data vectors do not exist.

Question 5: Configuration

a) Give the definition of the configuration task.

b) Mention the 4 (or else as many as possible) different kinds of knowledge which play a role in the configuration task.

Question 6: Diagnosis

a) Mention and briefly describe the three main subtasks of diagnosis.

b) Indicate briefly for each of the following approaches of diagnosis how well / easy the approach can be extended to be able to diagnose composite faults: plan-based diagnosis, diagnosis as classification, and model-based diagnosis.

End of the exam.