Exam Knowledge Systems
March 27th, 2003

Question	points
question 1: Knowledge Systems	10+10
question 2: Time & Space	10+10
question 3: Uncertainty	10+10
question 4: Classification	6+6+8
question 5: Diagnosis	4+8+8
TOTAL:	100
grade= number of points / 10	

Success!

Question 1: Knowledge systems

a. Give three advantages and two disadvantages of knowledge systems.

b. What is meant with ”symbol level” and ”knowledge level”?

ANSWER:

a. Advantages:

- Larger distribution and availability of expertise (in time, in location)
- (Relatively) easy to modify separation of knowledge & inference
- Consistent results
- Retains Expertise but: may be too rigid
- Solving problems with incomplete or uncertain data and knowledge
- Explanation of solutions

Disadvantages:

- No guarantee on correctness of results
- Limited knowledge
- without knowledge about the limitations
- lack of commonsense knowledge
- Ungraceful degradation brittle, performance cliff

b. symbol level: representation, implementation

knowledge level: reasoning steps, tasks, knowledge types, independent of implementation.

Question 2: Time & Space

a. What is the difference between ”linear time-line” and ”branching time-line”?

b. One uses sometimes in reasoning about spaces hierarchical representation and quadtrees. What is the aim of using respectively hierarchical representation and quadtrees?

ANSWER

a.

linear time-line: one past, one future.

branching time-line: representation of uncertainty about the knowledge of world with respect to the future and past. (No property of the world itself.)

b.

hierarchische representatie: possibility to use maps of different level of detail (more than 1 level of abstraction).

quadtrees:

takes care for a balance of the allocation of space for objects, if these objects are not equally distributed.

Question 3: Uncertainty

This question concerns the certainty factor model.

Given:
observation A, with certainty factor 0.7
observation B, with certainty factor 0.9
observation E, with certainty factor 0.8
rule: if A then C, certainty factor: 0.8
rule: if B then C, certainty factor: 0.9
rule: if C then D, certainty factor: 0.7
rule: if E then F, certainty factor:0.6
rule: if (D and F) then G, certainty factor:0.7

a. What is the certainty factor of G? Make clear how you come to the value of the certainty factor of G.

b. Give two problems with the certainty factor model.

ANSWER: a.

cf(A) = 0.7

cf(B) = 0.9

cf(E) = 0.8

cf(if A then C) = 0.8

cf(if B then C) = 0.9

cf(if C then D) = 0.7

cf(if E then F) = 0.6

cf(if (D and F) then G) = 0.7

cf(C | {if A then C, if B then C}) =

cf(A).cf(if A then C) = 0.7 * 0.8 = 0.56

cf(B).cf(if B then C) = 0.9 * 0.9 = 0.81

$x > 0, y > 0$: x+y-xy = 0.7 * 0.8 + 0.9 * 0.9 - (0.7 * 0.8 * 0.9 * 0.9) = 0.9164

cf(D) = cf(C) * cf(if C then D) = 0.9164 * 0.7 = 0.64148

cf(F) = cf(E) * cf(if E then F) = 0.8 * 0.6 = 0.48

cf(G) = cf(D&F) * cf(if D&F then G) = 0.48 * 0.7 = 0.336

cf(D&F) = min(cf(D), cf(F)) = min(0.64148, 0.48) = 0.48

cf(G) = 0.336

b.

CF(A or B) is close to 1 if and only if CF(A) is close to 1 or CF(B) is close to 1. However sometimes being certain about ”A or B” but not about one of them.

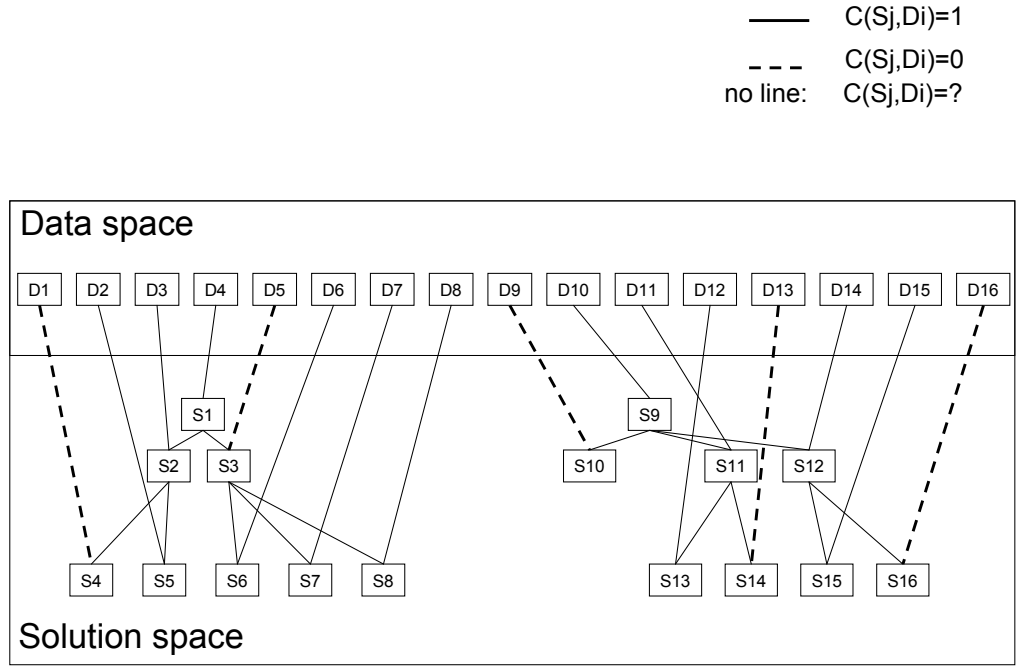
CF(A and B) is close to -1 if and only if CF(A) is close to -1 or CF(B) is close to -1. However sometimes being certain about not (”A and B”) but not about which one A or B is -1.

CF’s are dependent of the representation of KB.

Question 4: Classification

In this question the standard classification method ”MC4 data-driven hierarchical classification” must be used.

Given the following classification knowledge:



a. Give the possible candidate solutions with the observations D5=0 en D11=0.

b. Which data elements (observables) will be asked to the user in the next step?

c. Give an advantage of this method MC4 with respect to the two standard methods ”MC2 driving from data to plausible candidates” and ”MC3 solution-driven hierachical classification”

ANSWER:

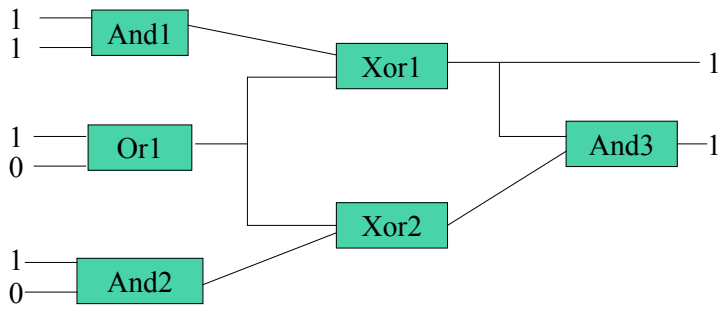
a. S6, S7, S8

b. d6,d7,d8

c. no irrelevant data will be asked.

Question 5: Diagnosis

Given the following system of components:



The correct behaviour of the different components is:

input1	input2	output AND	output OR	output XOR
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0

Answer the questions mentioned below within the context of GDE.

a. Do we have a diagnostic problem in above figure? Comment your answer.

b. What is a minimum conflict set, and give a minimum conflict set if there exists a minimum conflict set for the given system with the given observations (see figure. Comment your answer.

c. Assume we have a diagnostic problem with three minimal conflict sets, namely: {a1,a2,a3}, {a1,b1}, {b1,c1}. What is, on the basis of these three minimal conflicts sets, the set of minimal diagnoses? Comment your answer.

ANSWER:

a. Yes, expected behaviour is for output Xor1 and And3 both 0 instead of 1 (=observed behaviour)

b. At least one of the component has to be faulty. No subset of a minimal conflict is a conflict set. For instance {and1, or1, xor1}.

c. {a1,b1}, {a1,c1}, {a3,b1}, {a2,b1}

End of exam