KTH Microelectronics
and Information Technology

Exam in ID2209 Distributed Artificial Intelligence and Intelligent Agents, 2010-12-17, 14:00-18:00

Rules

This exam is “closed book” and you are not allowed to bring any material or equipment (such as laptops, PDAs, or mobile phones) with you. The only exceptions are English to “your favorite language” dictionary and pencils.

Instructions

- Please read the entire exam first!
- Write clearly
- Each sheet of paper must contain your name, ”personnummer”, Problem number and a
- Write only on one side of a sheet. Do not use the back side
- Only one Problem must be reported on each sheet
- If more than one sheet is needed the continuation should be clearly noted on the beginning of each sheet and the sheet numbers used should be consecutive
- Always motivate your answers. Lack of clearly stated motivation can lead to a reduction in the number of points given
- The tasks are not necessarily sorted in order of difficulty. If you get stuck it might be a good idea to go on to the next task.

Grading

The grades depend on the sum of exam and bonus points n:
$n < 50$ fail (F)
$50 \leq n < 60$ grade E
$60 \leq n < 70$ grade D
$70 \leq n < 80$ grade C
$80 \leq n < 90$ grade B
$90 \leq n$ grade A

GOOD LUCK!

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Problem I. What is an agent?

a) What are proposed weak and strong properties of agents? Briefly explain them and give an example for each of them.

(5p)

b) Explain difference between Distributed Problem Solving and Multi-Agent Systems.

(4p)

Problem II. Agent theory

a) We considered that intentional notions are not truth functional. Explain what it means.

(5p)

b) Express the following accessibility relations presented in the Figure 1.a and Figure 1.b using operators of modal logic:

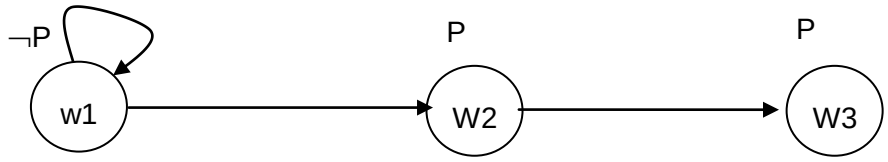

Figure 1.a

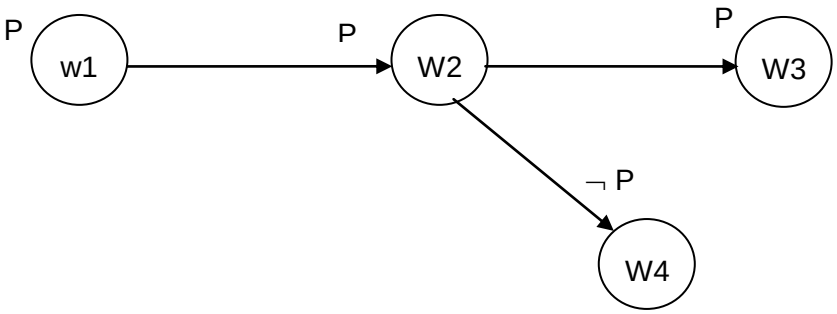

Figure 1.b

(5p)

c) What are relations between Beliefs, Desires, Goals and Intentions in the BDI-architecture?

(6p)

Problem III. Agent Architectures

a) Describe input/output parameters of the following functions in the agent's abstract architecture: see, next and action. Which of these functions will be used for specifying pure reactive agents and which of them will be used for specifying agents with state?

(5p)

b) What are key problems with symbolic reasoning agents?

(4p)

c) What is a difference between Brooks subsumption architecture and horizontal layered hybrid architecture?

(5p)

Problem IV. Negotiation

a) Explain difference between cooperative and self-interested agents. Give examples. How this difference can be expressed in terms of a utility function?

(5p)

b) Assume that τ denotes a state transformer function whose the first parameter is action of Agent1 and the second argument is action of Agent2. How do you characterize the following environments?

1) $\tau(D,D)=\omega 1$ $\tau(D,C)=\omega 1$ $\tau(C,D)=\omega 2$ $\tau(C,C)=\omega 2$
2) $\tau(D,D)=\omega 1$ $\tau(D,C)=\omega 2$ $\tau(C,D)=\omega 3$ $\tau(C,C)=\omega 4$
3) $\tau(D,D)=\omega 1$ $\tau(D,C)=\omega 1$ $\tau(C,D)=\omega 1$ $\tau(C,C)=\omega 1$
4) $\tau(D,D)=\omega 1$ $\tau(D,C)=\omega 2$ $\tau(C,D)=\omega 1$ $\tau(C,C)=\omega 2$

(5p)

c) What is dominant strategy? Give an example of dominant strategy. What is difference between dominant strategy and Nash equilibrium?

(5p)

d) Explain binary protocol for voting? What are possible outcomes of the binary protocol for the following set of preferences?

35% of agents have preferences c > d > b > a

32% of agents have preferences b > a > c > d

33% of agents have preferences a > c > d > b

(5p)

e) We considered an example of application of Clark tax algorithm to the case when Computer Science (CS), Electrical and Computer Engineering (ECEn) and Mechanical Engineering (ME) departments buying memory (see Tables 1 and 2). We assumed that Table 1 represents truthful ranking and Table 2 represents non truthful ranking. Explain using Clark tax algorithm why it is not profitable for CS department announce the non-truthful ranking?

i	$v_i(g)$		
	16TB	32TB	64TB
CS	1	2	3
ECEn	3	1	2
ME	3.5	1	2
$\sum_i v_i(g)$	**7.5**	**4**	**7**

Table 1. Truthful ranking

i	$v_i(g)$		
	16TB	32TB	64TB
CS	1	2	**4**
ECEn	3	1	2
ME	3.5	1	2
$\sum_i v_i(g)$	**7.5**	**4**	**8**

Table 2. Non-truthful ranking

(6p)

Problem V. Auctions

a) How auctions can be classified?

(5p)

Problem VI. Communication

a) We considered 3 important aspects of a language: syntax, semantics, and pragmatics. Briefly explain them and give examples.

(5p)

b) Which types of Speech acts (Illocutionary acts) do you know? Give examples.

(6p)

c) What is a purpose of KIF (Knowledge Interchange Format) in the context of agent communication languages?

(4p)

Problem VII. Coordination

a) We considered coordination as an effective control of distributed search. What are coordination activities in this case?

(5p)

b) Explain the following planning possibilities:

- centralized planning of distributed plans,
- distributed planning of centralized plans
- distributed planning of distributed plans.

(5p)

Problem VIII. MAS Architectures

a) Explain basic actions that ACTOR may perform.

(5p)

----------End of Exam----------