KTH Microelectronics
and Information Technology

Exam in ID2209 Distributed Artificial Intelligence and Intelligent Agents, 2016-01-13, 09:00-13:00

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 main differences between agents and objects?

(4p)

b) Analyze an elevator (lift) from an agent perspective. A simple elevator is a small room that carries people from one floor to another. It can be assumed to have two doors, a display indicating the floor it's on, buttons on the outside for the user to call it and buttons on the inside for the user to indicate the floor that he wants to move to.

Assume that the elevators are to be considered as intelligent agents. List ALL possible agent properties the intelligent elevator agents will have and illustrate these properties by examples.

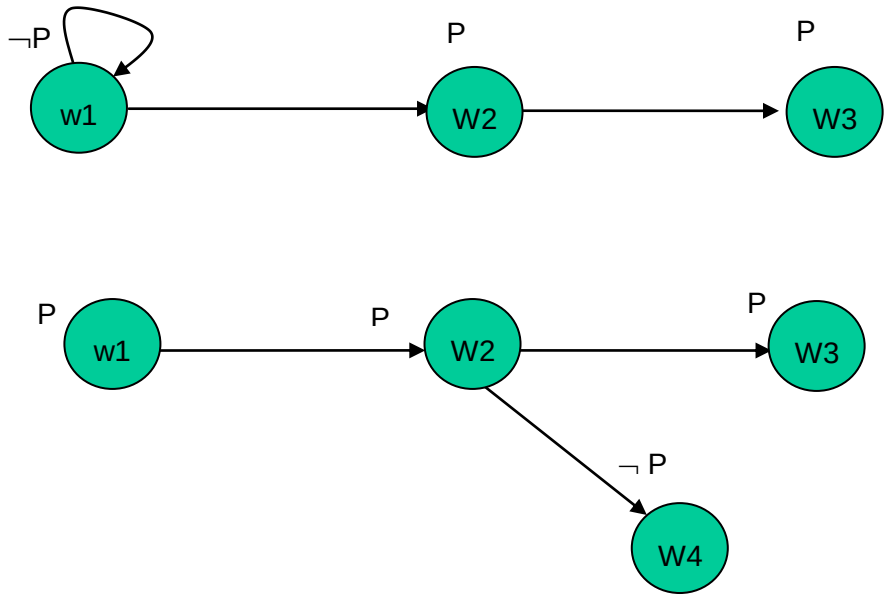
(6p)

Problem II. Agent theory

a) In the class we considered the Wise Man puzzle (see appendix) and we also considered possible worlds. What are the possible worlds in this puzzle at the beginning and after each man answer?

(6p)

b) Express the following accessibility relations presented in the figures below using operators of modal logic:



(5p)

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

(6p)

Problem III. Agent Architectures

a) Explain concepts of practical reasoning, theoretical reasoning, deliberation and means-end analysis. Give examples.

(5p)

b) What are key problems with symbolic reasoning agents?

(4p)

Problem IV. Negotiation

a) Which desired properties of protocols/mechanisms do you know? Briefly explain them.

(5p)

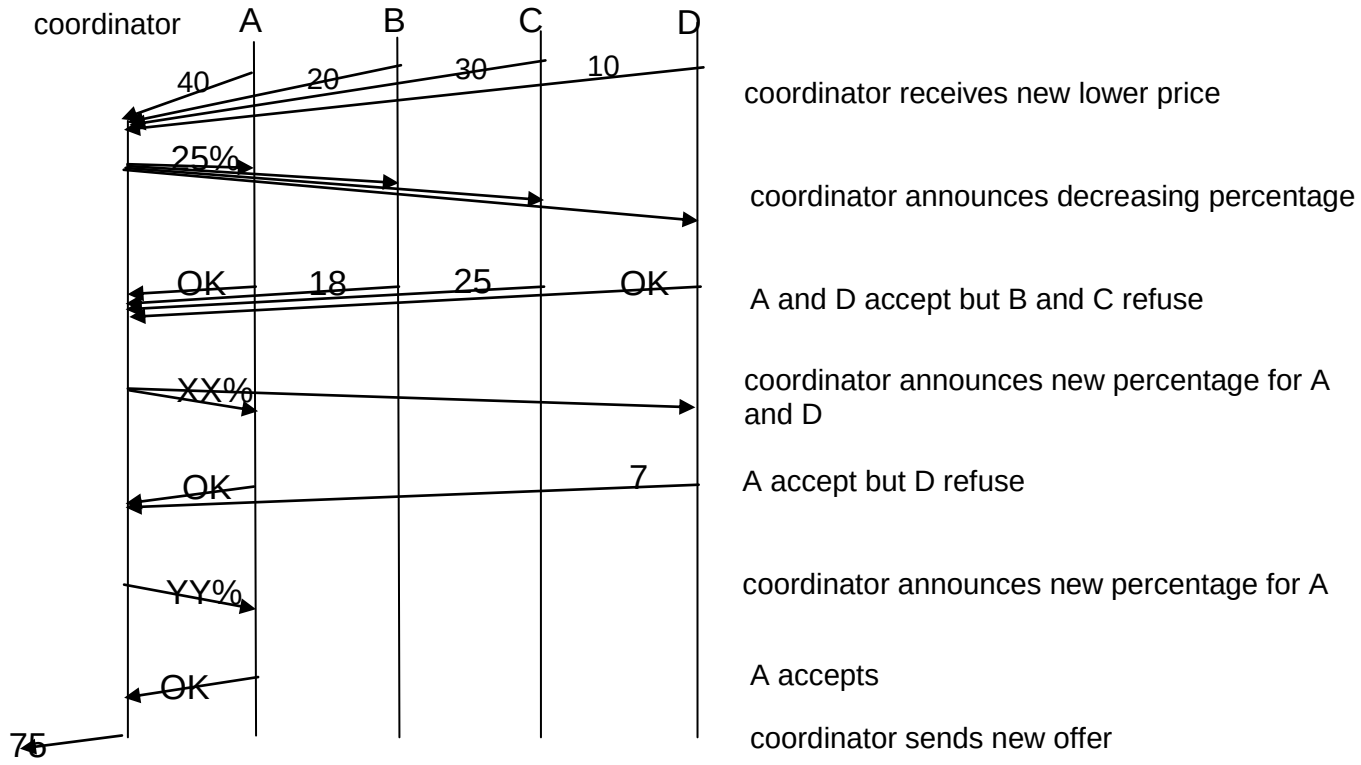
b) What is dominant strategy? Give an example of dominant strategy. What is difference between dominant strategy and Nash equilibrium?

(5p)

c) In class we considered an extended CNP for the case of a distributed system for resource managing in a building construction company (Foseca et al). One step in this example was intra-coalition negotiation according to the following algorithm:

1. coordinator calculates the percentage of the initial cost that coalition must decrease
2. announcing percentage
3. agents respond by accept or reject
4. if there are rejects then new percentage calculation and goto 2
5. coordinator informs the announcer about new coalition position

What will be percentage for decreasing costs denoted by XX and YY on the figure below? Explain your calculations.



(5p)

d) There are the following 3 basic questions that should be answered with respect to the Monotonic Concession protocol:

What should an agent's first proposal be?

On any given round, who should concede?

If an agent concedes, then *how much* should it *concede*?

What are answers to these questions? Explain your answer.

(5p)

e) What is Nash equilibrium in mixed strategy? Which property it has?

(5p)

Problem V. Auctions

a) We considered the second-price-sealed-bids or Vickrey auction. Does it make sense to have second-price-open-bids auction? Justify your answer

(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)

Problem VII. Coordination

a) Compare common coordination techniques in terms of predictability, reactivity and amount of information exchange.

(5p)

b) We considered Partial Global Planning approach to coordination. Why the planning is partial and why it is global in this approach?

(4p)

c) Explain “Explicit analysis and synchronization” approach to multi-agent planning. In which situation it may be practically applicable?

(5p)

Problem VIII. MAS Architectures

a) What is main idea of Blackboard architecture? What are its main components?

(4p)

Problem IX. Mobile Agents

a) How could you implement agent’s mobility if you only can use remote procedure call?

(5p)

Appendix

Three men puzzle.

There are three wise men.

It is common knowledge -- known by everyone, and known to be known by everyone, etc. -- that there are three red hats and two white hats. The king puts a hat on each of the wise men, and asks them sequentially if they know the color of the hat on their head. Suppose the first man says he does not know; then the second say he does not know either.

It follows that the third man must be able to say that he knows the color of his hat.

Why this and what color has the third man's hat?

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