KTH Microelectronics
and Information Technology

Exam in ID2209 Distributed Artificial Intelligence and Intelligent Agents, 2017-01-13, 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 an 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 unique sheet number
- Write only on one page 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 points m and bonus points n as follows:
$m+n < 50$ fail (F)
$50 \leq m+n < 60$ grade E
$60 \leq m+n < 70$ grade D
$70 \leq m+n < 80$ grade C
$80 \leq m+n < 90$ grade B
$90 \leq m+n$ grade A

GOOD LUCK!

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Problem I. What is an agent?

a) Let us consider a control system which regulates intensity of light in an auditorium as intelligent agent. Explain which intelligent agent properties this agent may employ. Illustrate your answer by examples.

(6p)

Problem II. Agent theory

a) Why Modal Logics are more suitable than Classical Logic for modeling intelligent agents? Explain your answer.

(6p)

b) Explain notions of “common knowledge” and “distributed knowledge”. Give examples.

(5p)

c) Formalize in the logic of knowledge the following problem:

"Agent A wants to find out cost of football tickets. Agent A doesn't know the cost but Agent A knows that Agent B exists. Agent B doesn't know the cost either but Agent B knows that Agent C exists. Agent C knows the cost".

(5p)

Problem III. Agent Architectures

a) Describe the different types of agent architectures and give an example of a situation where each of the architectures could be applied.

(5p)

b) Explain Brooks subsumption architecture. Give a simple example of its usage.

(5p)

c) What is deliberation? Which phases it consists of and what is its output?

(5p)

Problem IV. Negotiation

a) In the class we considered an example of conventions for negotiation in the postmen domain. For example, see Figure 1, where Agent1 should deliver letters from *a* to *f* and *b* and Agent2 should deliver a letter from *a* to *e*. However Agent1 may hide the letter to be delivered to *b*.

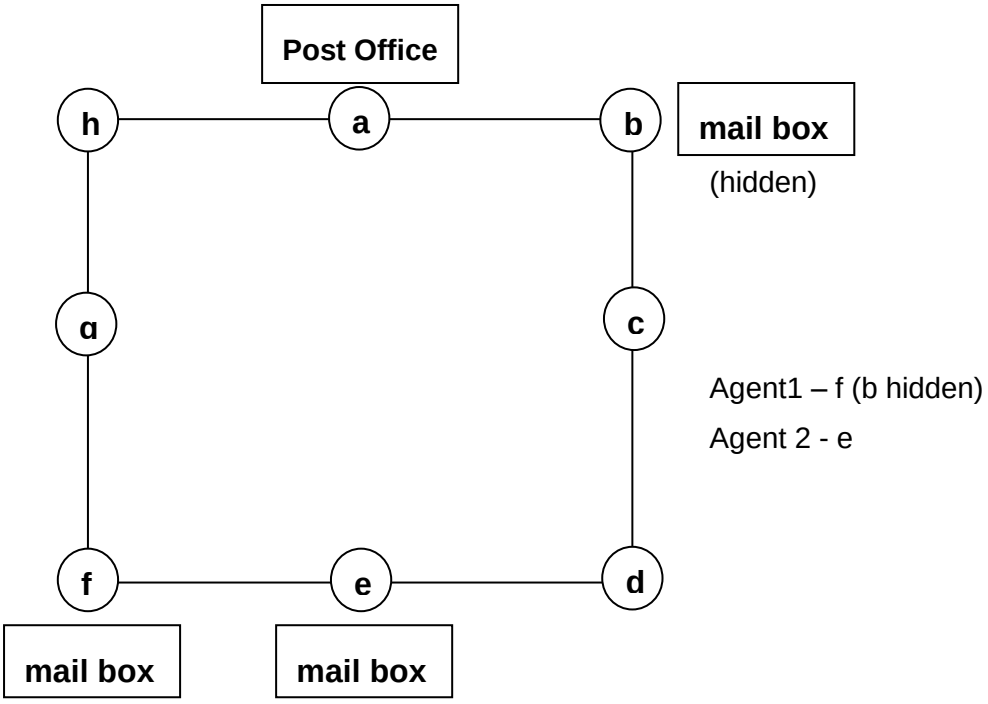

Figure 1

We considered that usage of probabilities and all-or-nothing deal agreement helps to get rid of deceptions.
Demonstrate that with using probabilities and all-or-nothing deal an expected cost for Agent1 of performing its task with hiding letter is greater than expected cost of performing the task without deception.

(6p)

b) What is the basic idea of the Zeuthen strategy? Explain a formula for calculation of risks in this strategy.

(5p)

c) What are worth-oriented domains? What is/are difference(s) between task-oriented and worth-oriented domains?

(5p)

d) Explain bid strategy for interrelated auctions.

(6p)

e) Why Nash equilibrium is a good property of negotiation protocol? Explain.

(5p)

Problem V. Communication

a) Describe the English auction using FIPA ACL communicative acts.

(5p)

b) Explain how do we describe semantics of speech acts? Give a brief example.

(5p)

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

(4p)

Problem VI. Coordination

a) Is it always necessary that coordinated actions are cooperative? Illustrate your answer by example(s).

(4p)

b) Consider a bicycle producer, whose goal is to produce bicycles of different types, e.g. racing bikes, mountain bikes. For simplicity, we can assume that a bicycle is a product that is built up of components like wheels, frames and seats. Some agents are used to perform the tasks that are required to produce the bikes. The agents that are used are:
- Product managers
- Producers of wheels, frames, seats, etc.
- Assemblers
- Testers

What are the different ways the agents may be organized to coordinate the production of the bicycles? Describe the different organizational structures, using figures wherever possible.

(5p)

c) Is it reasonable to use Partial Global Planning in air traffic control systems? Explain.

(4p)

Problem VII. MAS Architectures

a) Explain how an ACTOR behaves?

(5p)

Problem VIII. Agent-Oriented Software Engineering

a) What is rational behind designing the AgentUML?

(4p)

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