KTH Microelectronics and Information Technology

Exam in ID2209 Distributed Artificial Intelligence and Intelligent Agents, 2012-12-11, 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 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 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!

Mihhail Matskin, mobile 0704614269

Problem I. What is an agent?

a) The availability of TV channels is greatly extended in the information society. Media experts forecast that every household will be able to receive between 300 and 500 television programs in the near future. A quick estimate shows that a systematic search for interesting TV programs would take so much time that there would be hardly any time left to view the selected broadcasts.

Assume that you are supposed to help in solving this problem and to create an intelligent agent for that.

List ALL possible agent properties the intelligent TV agent will have and illustrate these properties by examples.

(6p)

Problem II. Agent theory

a) Explain what it means to consider agent as an intentional system. Give an example.

(5p)

b) Which axiom(s) from logic of knowledge is/are not valid in the logic of belief? Explain.

(4p)

c) If we assume that the statement "agent doesn't know whether p" is equal to "$\Diamond p \ \& \ \Diamond \neg \ p$" in modal logic. Express in the logic of knowledge the following statement:

"I don't know whether I know the answer and I don't know whether my neighbor knows the answer"

Explain your answer

(7p)

Problem III. Agent Architectures

a) What is a purpose of introducing the "see" function into an abstract agent architecture? Give an example.

(5p)

b) Show an implementation (in pseudo-code) of action selection function for agents in the subsumption architecture?

(6p)

c) What are basic types of layered agent architectures for hybrid agents?
Briefly explain their advantages and disadvantages

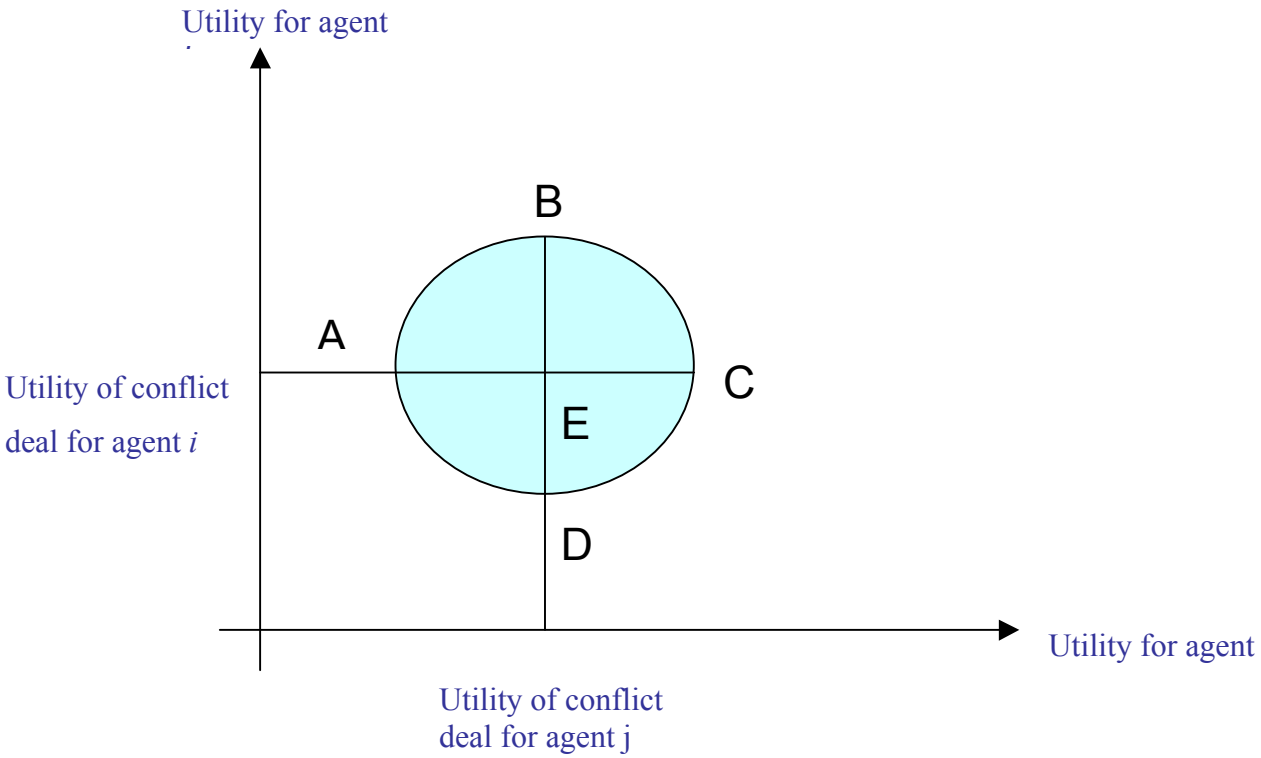
(5p)

Problem IV. Negotiation

a) Pareto efficiency is an important property in negotiation. Briefly explain it. What are relations between pareto efficient solutions and social welfare maximizing solutions?

(5p)

b) We considered the following figure in the class.



Show on the figure points/areas for:
Conflict deal, negotiation set, possible deals, Pareto optimal deals and individually rational deals.
Explain your answer.

(6p)

c) If we compare binary protocol and Borda protocol. Which of them is more computationally efficient? Which of them is not independent of irrelevant alternatives? Explain.

(5p)

d) We considered Clark tax algorithm. What is its objective? How it achieves this objective? (It is not necessary to present particular formulae in your answer)

(5p)

e) Draw a payoff matrix for the Prisoners dilemma (exact numbers should not necessarily be the same as in lecture notes). Which cells in this matrix correspond to: social welfare, Pareto optimal solution and Nash equilibrium? Explain your answer.

(5p)

Problem V. Communication

a) What is interoperation?

(4p)

b) Having semantics of the ***request*(*s*,*h*,α)** speech act as it was defined in lecture notes, which of the following statements are preconditions and which of them are post-conditions of this speech act?

- ***h* believes (*s* believes (*s* wants α))**
- ***s* believes (*h* believes (*h* can do α))**
- ***s* believes (*s* wants α)**
- ***s* believes (*h* can do α)**

(4p)

c) Give basic ideas of the agent communication languages KQML and FIPA. What do they have in common and what are basic differences between them?

(5p)

Problem VI. Coordination

a) Explain main organizational structures that you know. Give their advantages and disadvantages.

(5p)

b) What are the main characteristics of meta-level information exchange coordination?

(4p)

c) Give examples of social norms and laws in agent coordination. What is difference between them?

(5p)

Problem VII. MAS Architectures

a) What is/are main difference(s) between MAS architectures that use middle agents and market-based MAS architectures?

(5p)

Problem VIII. Mobile agents

a) Give examples of situations (at least 2 situations) where mobile agents are appropriate (when they have benefits over communicating non-mobile agents)? Justify your answer.

(4p)

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