



## **Exam in ID2209 Distributed Artificial Intelligence and Intelligent Agents, 2007-12-19, 14:00-19:00**

### **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 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) 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.

(8p)

## Problem II. Agent theory

a) What are relations between beliefs, goals, desires and intentions in the BDI-architecture?

(6p)

b) Let us we assume that “whether p” is equal to “ $\Diamond p \wedge \Diamond \neg p$ ” in modal logic. Express in the logic of knowledge the following statement:

“I don’t know whether I know the answer”

Explain your answer.

(8p)

## Problem III. Agent Architectures

a) Which types of agent architectures you know? Briefly compare their advantages and disadvantages.

(6p)

b) Explain the following notions: theoretical reasoning, practical reasoning, deliberation and means-end analysis. Give examples.

(6p)

## Problem IV. Negotiation

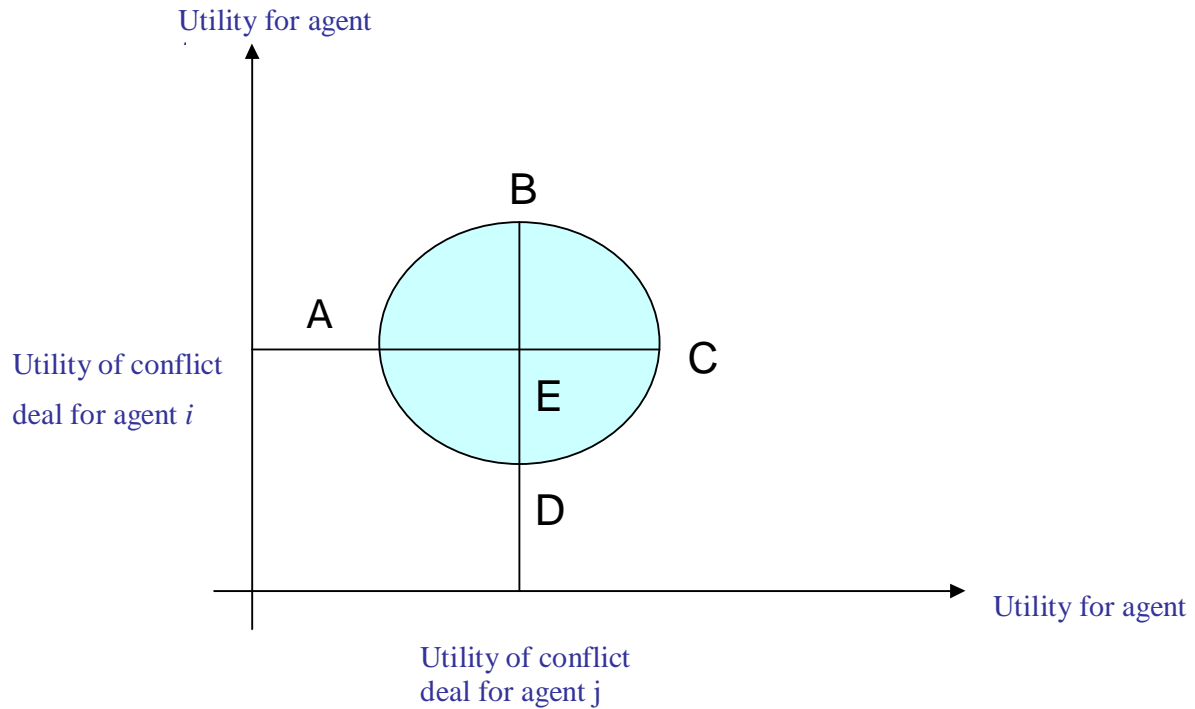
a) What are desirable properties of negotiation protocols? Briefly explain them

(6p)

b) Explain what is utility and what is preference and how they are related?

(6p)

c) 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)

## Problem V. Auctions

a) Explain what is a bid strategy for interrelated auctions.

(6p)

## Problem VI. Communication

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

(6p)

b) Explain how different performative verbs applied to the same propositional content can express different speech acts. Give an example.

(6p)

c) What are main motivations for developing KIF?

(6p)

## Problem VII. Coordination

- a) Explain main organizational structures that you know. Give their advantages and disadvantages.  
(6p)
- b) What is/are difference(s) between Partial Global Planning and multi-agent planning?  
(6p)

## Problem VIII. MAS Architectures

- a) What is/are main difference(s) between MAS architectures that use middle agents and market-based MAS architectures?  
(6p)

## Problem IX. Mobile agents

- a) Describe a simple way of implementing agent mobility using Remote Procedure Calls (RPC).  
(6p)

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