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EXAM IN 78045
DISTRIBUTED ARTIFICIAL INTELLIGENCE AND
INTELLIGENT AGENTS
MONDAY 6 DECEMBER 1999, 9AM - 1 PM

Example Solution

Approved calculator allowed.
NO printed and hand-written material is allowed.

Godkjent lommekalkulator tillatt.
Ingen trykte eller håndskrevne hjelpemidler tillatt.

Problem I. What is an agent? (20%)

- 1) The availability of TV channels will be greatly extended in the information society. Media experts forecast that shortly after the new millennium, every household will be able to receive between 300 and 500 television programs. 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 features the intelligent TV agent will have and illustrate these features by examples.

Answer:

- The user informs the agent of his TV preferences: delegation RBK games and X-files serial, agent search in available digital TV programs on behalf of the user and then inform user what will be shown on TV concerning RBK and X-files.
- Agent acts autonomously- without intervention from user, the agent continuously follows the new broadcasts and television programs and could provide the user with new information on his areas of interest.
- Pro-activity - the agent may not only inform user about TV broadcast of RBK games or X-files but also about programs with interview with RBK players (X-files actors) or inform about games of RBK competitors.
- Reactivity - the agent can react to changes in TV schedule.
- Social ability - the agent can communicate to other (TV) agents and ask their opinion about some programs or knowledge of related subjects or help - if I can't find a program for some channel then I can ask for other agents or trying to contact brokers.
- Mobility - the agent can move from one computer to another when traversing the TV programs.
- Benevolence - the agent will always try to do what is asked of it.
- Veracity - the agent will not reply with false information.
- Rationality - the agent has a purposeful behavior - to inform user about interested programs. its rationality is oriented to optimal satisfaction of users preferences, f/e scheduling trying to avoid collisions in watching favorite programs (by finding the same program on different channels in different time).

Problem II. Theory (18%,10%)

- 1) Formalize the following statements in the logic of knowledge (we consider logic of knowledge as a modal logic with K_i operator):

2) a) $\tan(\theta) = \frac{1200}{1450} = 0.83$ b) $\tan(\theta) = \frac{1200}{1450} = 0.83$ c) $\tan(\theta) = \frac{1200}{1450} = 0.83$ d) $\tan(\theta) = \frac{1200}{1450} = 0.83$ e) $\tan(\theta) = \frac{1200}{1450} = 0.83$ f) $\tan(\theta) = \frac{1200}{1450} = 0.83$ g) $\tan(\theta) = \frac{1200}{1450} = 0.83$ h) $\tan(\theta) = \frac{1200}{1450} = 0.83$ i) $\tan(\theta) = \frac{1200}{1450} = 0.83$ j) $\tan(\theta) = \frac{1200}{1450} = 0.83$ k) $\tan(\theta) = \frac{1200}{1450} = 0.83$ l) $\tan(\theta) = \frac{1200}{1450} = 0.83$ m) $\tan(\theta) = \frac{1200}{1450} = 0.83$ n) $\tan(\theta) = \frac{1200}{1450} = 0.83$ o) $\tan(\theta) = \frac{1200}{1450} = 0.83$ p) $\tan(\theta) = \frac{1200}{1450} = 0.83$ q) $\tan(\theta) = \frac{1200}{1450} = 0.83$ r) $\tan(\theta) = \frac{1200}{1450} = 0.83$ s) $\tan(\theta) = \frac{1200}{1450} = 0.83$ t) $\tan(\theta) = \frac{1200}{1450} = 0.83$ u) $\tan(\theta) = \frac{1200}{1450} = 0.83$ v) $\tan(\theta) = \frac{1200}{1450} = 0.83$ w) $\tan(\theta) = \frac{1200}{1450} = 0.83$ x) $\tan(\theta) = \frac{1200}{1450} = 0.83$ y) $\tan(\theta) = \frac{1200}{1450} = 0.83$ z) $\tan(\theta) = \frac{1200}{1450} = 0.83$.) $\tan(\theta) = \frac{1200}{1450} = 0.83$ TT51

Problem I . Communication (5%, 7%)

- 1) Can KQML be used as an agent development language? Explain.

Answer: No, it is an agent communication language and does not have features for presenting agent but only communication between agents.

- 2) Is it possible to write a KQML message where content is also expressed in KQML? Justify if not, give an example if yes

Answer: Yes, the content of KQML could be written in every language including KQML.

Problem . Agent architectures (3%,5%)

- 1) What are basic types of layered agent architectures?

Answer: Horizontal (all layers are connected with input and output) and vertical (not all layers connected to input and output) layers.

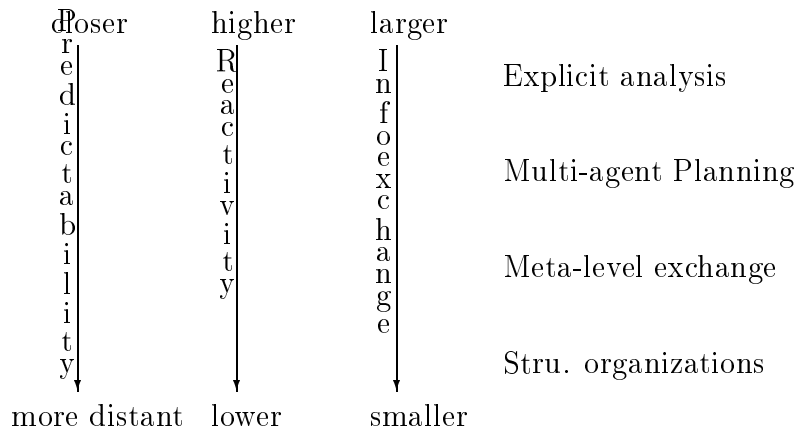
- 2) What kind of layered architecture is Brooks subsumption architecture. Explain.

Answer: Horizontal - all layers are connected with inputs and outputs.

Problem I. Coordination (3%,5%)

- 1) Name types of coordination techniques and range them according to predictability and information exchange?

Answer: The common coordination techniques are explicit analysis, multi-agent planning, meta-level exchange and organizational structures. (no explicit analysis in Amund's lecture notes)



2) What are fundamental coordination processes? Give a brief explanation

Answer:

- Mutual adjustment - each party adjust its behavior taking into consideration behaviour of partner.
- Direct supervision - one agent becomes server another client, this is not centralization because of this is done dynamically.
- Standardization - e.g. traffic rules.

Problem II. Mobile agents (4%)

1) What is difference between remote execution and mobile agent?

Answer:

remote execution is a program which is sent without execution state to remote CPU executes there, possibly communicating with other CPUs and then terminates (Java programs would fall into this class)

mobile agent is a program which carries execution state with it and is sent to a remote CPU executes there, possibly communicating with other CPUs and then moves again to a third CPU or returns to its origin.