King's College London

UNIVERSITY OF LONDON

This paper is part of an examination of the College counting towards the award of a degree. Examinations are governed by the College Regulations under the authority of the Academic Board.

Enter your candidate number in the box provided above and on the answer book(s) provided. Do this now.

MSc EXAMINATION

CSMACL – AGENT COMMUNICATION LANGUAGES

JANUARY 2003

TIME ALLOWED: TWO HOURS.

ANSWER QUESTION 1, AND ANY 2 OF THE REMAINING QUESTIONS 2, 3, AND 4. NO CREDIT WILL BE GIVEN FOR ATTEMPTING ANY FURTHER QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

THE USE OF ELECTRONIC CALCULATORS IS **NOT** PERMITTED.

BOOKS, NOTES OR OTHER WRITTEN MATERIAL MAY **NOT** BE BROUGHT INTO THIS EXAMINATION.

NOT TO BE REMOVED FROM THE EXAMINATION HALL

TURN OVER WHEN INSTRUCTED

1. Applications - JADE.

Suppose you are to design a Multi-Agent system managing the seat booking facility for a theatre using JADE. The system manages requests from agents enquiring about availability of seats, and wishing to make a booking.

a. Draw a diagram for an agent platform architecture for the server-side under the assumption it will work under JADE. What parts of the system need to be designed and implemented, and what parts are automatically provided by JADE? What other JADE tools can be used to debug and test the system?

[15 marks]

b. Which performatives would you implement for the server? Which performatives would you implement for the client?

[15 marks]

c. Briefly sketch the structure of a Java program for the client, assuming that you can use JADE packages. Briefly sketch the structure of a Java program for the server. You may assume you have a database for the registration of successful transactions.

[20 marks]

2. Theoretical Background.

a. Succinctly define a Multi-Agent System, and briefly compare Agent Oriented Programming to Object Oriented Programming.

[15 marks]

b. Briefly define interpreted systems, and point out the differences between this semantics and standard Kripke models.

[15 marks]

c. Briefly describe the formalism of (Cohen and Levesque, 1990a) for modelling intentions. How is the intention of agent i to perform action α defined?

How can the speech act `request` be defined in terms of beliefs, goals, and intentions in the formalism of (Cohen and Levesque, 1990b)?

[20 marks]

3. Communication and KQML.

a. Modelling and implementing communication between processes was an important issue even before the area of Multi-Agent systems emerged. Discuss the most basic way in which communication can be implemented in Object Oriented Programming and compare this to Multi-Agent Programming. Discuss the "lost update problem".

[15 marks]

b. Briefly describe the KQML/KIF paradigm for communication in Multi-Agent systems. Discuss the limitations of the KQML model.

[15 marks]

c. Write a dialogue between three agents exchanging messages in KQML in which:

- Agent C (Customer) asks for the price of the book `[Austin, How to do things with words]`.
- Agent A (Amazon.com) answers with a price of £20 and a waiting time of 2 weeks.
- Agent B (Bol.com) answers that they are not able to source the book.

Assume that the content language is an appropriate KIF-dialect defined by you.

[20 marks]

4. Communication and FIPA.

a. Briefly describe FIPA's architecture, spelling out its main components and the tasks they are supposed to perform.

[15 marks]

b. Briefly describe any two of FIPA's supported performatives.

[15 marks]

c. Give FIPA's semantics for inform and request.

Give a Kripke model that satisfies FIPA's feasibility precondition of $< i, inform(j,p) >$.

[20 marks]