

S228/407

DUBLIN INSTITUTE OF TECHNOLOGY
KEVIN STREET, DUBLIN 8.

BSc Computer Science

Stage 4

SUMMER EXAMINATIONS 2008

KNOWLEDGE BASED SYSTEMS II

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2 HOURS

ATTEMPT **3** QUESTIONS

ALL QUESTIONS CARRY EQUAL MARKS

1. (a) Describe what is meant by the *action selection problem* for modular, autonomous agents. Use examples to demonstrate the various difficulties associated with this problem.

(8 marks)

- (b) Reinforcement learning methods represent one approach to building a sub-symbolic knowledge base for autonomous agents. Provide and describe the *update rule* for the Q-Learning algorithm for reinforcement learning, and using a simple example of your choice, demonstrate its operation.

(10 marks)

- (c) Describe three methods for performing action selection based on actions propagated by agents and weighted according to their calculated reinforcement learning values.

Frame each method as a pattern, illustrating, among other things the contexts in which they are most appropriate, and the contexts in which they serve no function.

(15 marks)

2. (a) Describe in detail what is meant by the term *agent*, distinguishing it clearly from the term *object* as used in software development.

(10 marks)

- (b) In the mid 1990s, *multi-agent systems* seemed to promise a *new revolution in software*, particularly for complex software systems.

Present a detailed discussion of the above statement, referring in your answer to the following:

- i. The reasons why it was felt that the agent-oriented approach would begin to dominate software development.

(10 marks)

- ii. Your opinion on the reasons why this revolution did, or did not, take place.

(7 marks)

- iii. Whether and why this revolution may or may not take place in the future.

(6 marks)

3. (a) Describe the relationship between *agent communication languages* and *speech act theory*.

(8 marks)

- (b) Illustrate the operation of the *FIPA contract net interaction protocol* and identify situations where it should be used, and also situations where it does not fully satisfy requirements.

(10 marks)

- (c) Consider the following scenario:

The participants in a multi-agent system need to elect a single agent to take on the role of coordinator. All agents in the system have the capability to take on this role.

Devise and present an interaction protocol which can be used by the agents to carry out this election.

Provide a brief discussion of the strengths and weaknesses of your protocol.

(15 marks)

4. Consider the system described below:

We require a system for managing student examination results. Examiners must be able to add marks to the system and change marks before they are published. Administrators must be able to view marks and generate reports for students. Students must be informed when marks have been published. Once marks are published they are stored in a history database and cannot be changed unless students appeal. Students must be able to submit appeal applications through the online system. When they appeal, the lecturer must be informed, must recheck the mark, and must submit a result through the system. All users must be authenticated using passwords, and all interfaces must be user friendly.

Provide a high level design for this system using the *Prometheus* methodology. State any assumptions you make.

Marks will be allocated as follows:

- (a) System Specification

(18 marks)

- (b) Architectural Design

(15 marks)