UNIVERSITY OF LONDON

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1999

BEng Honours Degree in Computing Part III
MEng Honours Degree in Computing Part III
BEng Honours Degree in Information Systems Engineering Part III
MEng Honours Degree in Information Systems Engineering Part III
MSc Degree in Advanced Computing
for Internal Students of the Imperial College of Science, Technology and Medicine

This paper is also taken for the relevant examinations for the
Diploma of Membership of Imperial College
Associateship of the Royal College of Science

PAPER 3.12 / I 3.10

LOGIC ENGINEERING

Friday, April 30th 1999, 2.30 – 4.30

Answer THREE questions

For admin. only:
paper contains 4 questions

1   Natural language understanding can be viewed as a process of interpreting natural language sentences into logical form. Viewing natural language in this way, a communicator can exploit logic to formulate natural language communications in a manner that facilitates their understanding.

a   How might viewing natural language in this way help a communicator to improve the clarity of human language communication? Give examples to illustrate your answer.

b   How might viewing natural language in this way help a communicator to improve the coherence of human language communication? Give examples to illustrate your answer.

c   By analogy with the relationship between the syntax, proof theory and semantics of logic, what does this logical view of natural language tells us about the relationship between human language, human thinking and human experience?

The three parts carry equal weight.

2a   Reformulate, in informal logical notation, the following imaginary provisions concerning a blind person's allowance:

    i)   Every blind person is eligible to receive a blind person's allowance.

    ii)   Anyone who does not pass the prescribed vision test shall be deemed blind for the purpose of being eligible to receive a blind person's allowance.

    iii)   Except as provided for in (iv) below and despite (i) and (ii) above, no one who has the use of a ministry-approved personal image-recognition system shall be eligible to receive a blind person's allowance.

    iv)   Anyone who has the use of a ministry-approved personal image-recognition system shall be eligible to receive a blind person's allowance, if the person can show that it is not fully functional.

b   The provisions above do not take time into account. Reformulate, in informal logical notation, the four provisions above to take into account the fact that eligibility to receive a blind person's allowance applies for whole periods of one week, and that a person is eligible for such an allowance if the person is deemed to be blind at any time during that week.

The two parts carry 80%, 20% of the marks respectively.

3a   Formalise the following problem in the clausal form of logic:

Given   on(a,b) on(b,c) green(a) ¬green(c)

Show $\exists x \exists y[green(x) \wedge on(x,y) \wedge \neg green(y)]$

b   Construct a solution of the problem by constructing an appropriate semantic tree.

c   Construct a solution by means of a resolution proof corresponding to the semantic tree of part (b).

The three parts carry equal weight.

4a   Define the notion of stable semantics for any abstract framework for defeasible reasoning.

b   Show how the abstract definition of part (a) can be instantiated for the case of logic programming.

c   Give an example of a logic program which has two stable extensions. Explain why each extension is in fact a stable extension.

d   Give an example of a logic program which has no stable extensions. Explain why it has no stable extensions.

The four parts carry equal weight.

[End of paper]