

UNIVERSITY OF LONDON
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1997

MEng Honours Degrees in Computing Part IV
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 City and Guilds of London Institute*

PAPER 4.98

NON-MONOTONIC AND META-LEVEL REASONING

Thursday, May 1st 1997, 10.00 - 12.00

Answer THREE questions

For admin. only: paper contains 4
questions

1 Use the following abbreviations for this question:

renounce(X, T)	for	X renounces UK citizenship at time T
register(X, T)	for	the renunciation of UK citizenship by X is registered at time T
cease(X, T)	for	X ceases to be a UK citizen
acquire(X, T)	for	X acquires UK citizenship
citizen(X, T)	for	X is a UK citizen at time T
believe(X, S, T)	for	X believes S at time T
non-uk-citizen(X, T)	for	X holds citizenship of a country other than the UK at time T
$T_1 < T_2$	for	time T_1 is before time T_2 .

a Formalise the following sentences:

- i) If any UK citizen renounces UK citizenship, then the Secretary of State shall register the renunciation thirty days after the renunciation is made.
- ii) On the registration of a renunciation of UK citizenship the person who made the renunciation shall cease to be a UK citizen.
- iii) A person who acquires UK citizenship is a UK citizen at any time after acquisition, provided the person does not cease to be a UK citizen at any other time between the time of acquisition and that time.

b Formalise the following sentence:

- iv) A renunciation of UK citizenship shall not be registered unless the Secretary of State believes that the person who made it will after the registration hold citizenship of a country other than the UK.

Assuming that (iv) has higher priority than (i), how does the formalisation of (i) or (iv) have to be changed, if at all, to reflect that priority.

c Formalise the following sentence:

- v) If a renunciation of UK citizenship has been registered and the person who made it does not hold citizenship of a country other than the UK within six months from the date on which the renunciation was registered, then the person shall not have ceased to be a British citizen notwithstanding the registration.

Assuming that (v) has higher priority than (ii), how does the formalisation of (ii) or (v) have to be changed, if at all, to reflect that priority.

d Formalise the following sentence

- vi) If a renunciation of UK citizenship has been registered and the person who made it does not hold citizenship of a country other than the UK within six months from the date on which the renunciation was registered, then the person shall reacquire British citizenship six months after the date of the registration.

How does the formalisation of parts a, b and c compare with the formalisation of parts a, b and d with respect to the consequences for UK citizenship of a person whose renunciation is registered at a time t but does not receive citizenship of any other country between time t and six months after t ?

The four parts carry, respectively, 10%, 30%, 30% and 30% of the marks.

- 2 a Show that Horn clause metalogic can implement any monotonic logic.
- b How does Horn clause metalogic need to be extended to implement non-monotonic logic?

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

- 3 Which of the following sentences is justified? In each case explain why or why not. (For simplicity, the distinction between a sentence and a term which names a sentence is to be understood as given by the context.)

$\text{demo}(T, P) \leftarrow \text{demo}(T, P \leftarrow Q) \wedge \text{demo}(T, Q)$
 $\text{demo}(T, P \leftarrow Q) \leftarrow [\text{demo}(T, P) \leftarrow \text{demo}(T, Q)]$
 $\text{demo}(T, P(Y)) \leftarrow \text{demo}(T, \forall X P(X))$
 $\text{demo}(T, \forall X P(X)) \leftarrow \forall Y \text{demo}(T, P(Y))$
 $\text{demo}(T, \neg P) \leftarrow \neg \text{demo}(T, P)$
 $\neg \text{demo}(T, P) \leftarrow \text{demo}(T, \neg P)$
 $\text{demo}(T, P \vee Q) \leftarrow \text{demo}(T, P) \vee \text{demo}(T, Q)$
 $\text{demo}(T, P) \vee \text{demo}(T, Q) \leftarrow \text{demo}(T, P \vee Q)$
 $\exists Y \text{demo}(T, P(Y)) \leftarrow \text{demo}(T, \exists X P(X))$
 $\text{demo}(T, \exists X P(X)) \leftarrow \text{demo}(T, P(Y))$

Turn over...

4 Various semantics for non-monotonic reasoning can be given an argumentation-theoretic interpretation.

a Give argumentation-theoretic interpretations for both the stable semantics and the admissibility semantics applied to logic programs.

Give an example where the stability and admissibility semantics give different results. Explain what these results are. Justify your answer by showing how the results conform to the semantics.

b Give an argumentation-theoretic interpretation for the weakly stable semantics applied to logic programs.

Give an example where the stability, admissibility and weakly stable semantics all give different results. Explain what these results are. Justify your answer by showing how the results conform to the semantics.

c In what sense is the admissibility semantics a semantics and not a proof procedure? Illustrate your answer by comparing the admissibility semantics with a proof procedure for computing admissibility semantics applied to the logic program

p if not q
 q if not r .

The three parts carry, respectively, 45%, 30% and 25% of the marks.

End of paper