UNIVERSITY OF LONDON

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1996

BEng Honours Degree in Computing Part III
BSc Honours Degree in Mathematics and Computer Science Part III
for Internal Students of the Imperial College of Science, Technology and Medicine

This paper is also taken for the relevant examinations for the Associateship of the City and Guilds of London Institute Associateship of the Royal College of Science

PAPER 3.27

LOGIC PROGRAMMING—APPLICATIONS

Monday, April 29th 1996, 2.00 - 4.00

Answer THREE questions

For admin. only: paper contains
4 questions
2 pages (excluding cover page)

1 A major railway terminus is installing a timetable database implemented in Prolog.

You have been asked to create a natural language front-end for this database that will be able to cope with queries such as:

When does the train to Manchester leave?
What time does the train from Leeds arrive?

a Express, in Prolog grammar rule form, a definite clause grammar for a fragment of English containing these two questions.

b Extend the grammar rules so that they construct the underlying logical (semantic) form of sentences.

The two parts carry, respectively, 45%, 55% of the marks.

2a Give the top-level *demo* code for an expert system shell that provides "How" explanations and a Query-the-User facility, including "Why" explanations. Assume that when the system queries the user about a goal which could have several solutions, it may return later in the session to elicit a fresh answer from the user, until the user indicates that she has no more answers to give.

b Carefully explain how the system stores answers provided by the user during the session and avoids returning later to query the user again, once she has indicated that she has no more answers to that query.

c Describe how a shell, such as the one referred to in parts a and b above, could be improved to provide a more natural style of interaction, by employing pieces of "canned text" stored in the database.

The three parts carry, respectively, 30%, 30%, 40% of the marks.

3a A list is a *palindrome* if it looks the same whether read forwards or backwards. For example, [1, 2, 3, 2, 1] is a palindrome. Write a Prolog program, palindrome(X), in terms of append, meaning that X is a palindrome.

b Give the difference-list form of append.

c Using parts a and b, derive a Prolog definition for palindrome that does not involve append.

d A finite list, whose terms can only be the numbers 1, 2 or 3, is called *acceptable* if it does NOT contain two identical consecutive sublists. For example, [3, 2, 1, 3, 1, 2] is acceptable, whilst [3, 2, 1, 2, 1, 3] is not. Write a Prolog program, acceptable(L), that can be used both to test for and to generate acceptable lists.

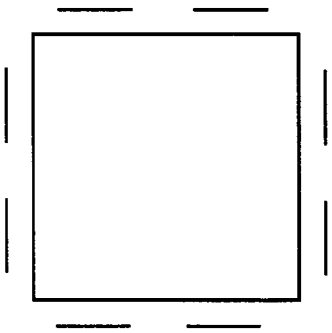
The four parts carry, respectively, 10%, 10%, 30%, 50% of the marks.

Turn over ...

4 Eight final year students: Albert, Brenda, Charles, Diana, Edward, Fiona, Graham and Hilda, went to dinner to celebrate the end of their exams. Of the eight:

one Shares a flat with Albert,
another is extremely Tall,
another carries an Umbrella,
another has a loud Voice,
another looks Worried,
another plays the Xylophone,
another has seen a Yeti, and
another comes from Zululand.

They all sat around a table for eight whose seating arrangement is shown below:



The student with the loud voice sat directly opposite Diana. Edward sat between the very tall student and the one with the loud voice. The one with the umbrella sat directly opposite Edward and on the right of Albert. Hilda, who lived in hall, sat to the right of Charles, who put his umbrella under his chair. The student who sat directly opposite Brenda and between Charles and the student from Zululand, had a worried expression. Fiona sat to the right of the student who had seen the Yeti and directly opposite the Xylophone player, who, in turn, sat next to Graham. Who shares the flat with Albert?

YOU ARE NOT REQUIRED TO ACTUALLY SOLVE THIS BRAINTEASER!

a Write clauses in ELIPSYS that express the seating constraints "directly opposite", "between", "on the right of" and "next to".

b Write the lower level code that implements a scheme for labelling the domain variable elements of a list.

c Give the ELIPSYS code for the top-level clause *solve(name)* and any subsidiary clauses other than those given in parts a and b that finds the name of the student who shares the flat with Albert.

The three parts carry, respectively, 40%, 15%, 45% of the marks.

End of paper