UNIVERSITY OF LONDON

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1999

BEng Honours Degree in Computing Part II
MEng Honours Degrees in Computing Part II
BSc Honours Degree in Mathematics and Computer Science Part II
MSci Honours Degree in Mathematics and Computer Science Part II
BSc Honours Degree in Mathematics and Computer Science Part III
MSci 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 Royal College of Science
Associateship of the City and Guilds of London Institute

PAPER 2.11 / MC 2.11

ARTIFICIAL INTELLIGENCE I

Thursday, May 13th 1999, 2.00 – 3.30

Answer THREE questions

For admin. only:
paper contains 4 questions

1a State the three design principles behind Schank's Conceptual Dependency theory (CD).

b Describe the basic components of an event in CD and the two types of basic primitive, giving examples of each.

c The events described by the sentences below have a common CD action. Outline a CD representation for each one, showing how the meaning of each sentence is distinguished in CD even though a common action is used.

The buttered toast fell from the table.
A stone hit the window.
The yacht sailed out of the harbour.
Lunar explorer-V took off yesterday.
The old car struggled up the hill.

d Indicate what elements need to be present in the CD representations that are not explicit in the sentences in part c.

e Suggest several inferences which could be associated with the common primitive action used above (possibly depending upon the particular object) and state some of the conclusions that might be drawn from the examples in part c.

The five parts carry, respectively, 20%, 25%, 25%, 15% and 15% of the marks.

2 AI could be defined as "the pursuit of Intelligence".

a Briefly explain the two main streams of AI research from this viewpoint.

Describe one program from each stream which might be considered a "success" of that line of research and comment on the quality of "Intelligence" exhibited by each.

b Lenat's Automated Mathematician program (AM) is claimed to have discovered non-trivial results in number theory. Sketch out the structure and operation of the AM program, briefly outlining some of its achievements and limitations.

c Outline two other factors which you feel characterise "intelligent behaviour" and suggest some ways in which this behaviour could be exhibited by a program.

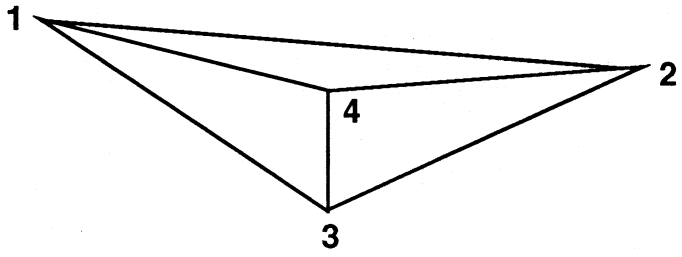
d Suggest some human characteristics which you feel would be very difficult or impossible for a computer program to simulate. Indicate briefly why you think they are so problematic.

The four parts carry, respectively, 30%, 30%, 25% and 15% of the marks.

3a Briefly explain the principles behind the line labelling approach to scene recognition.

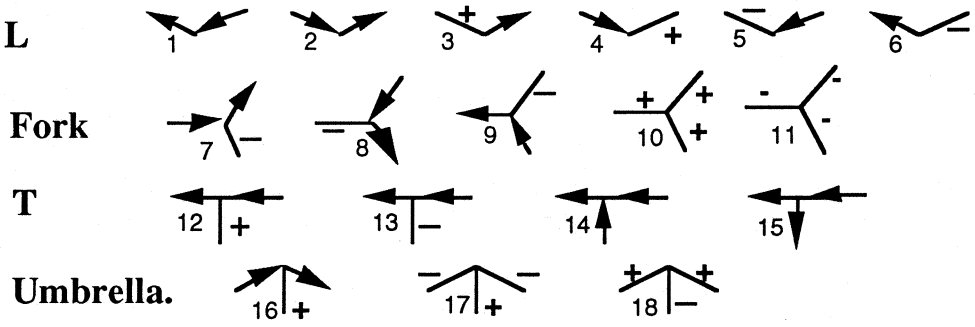
What assumptions are usually made about a scene to assist the interpretation process and how do they help?

b Describe carefully the WALTZ algorithm and use it to find all the consistent trihedral world labellings of the following scene. Give physical interpretations of the labellings, if possible.



c Outline the extra factors that must be taken into account to allow more realistic scenes to be analysed. Indicate what problems remain with this labelling approach, even with these extensions, and suggest briefly how they might be tackled.

For your reference the possible labellings of vertices are:-



The three parts carry, respectively, 25%, 50% and 25% of the marks.

4a What is meant by *hill climbing* as a method of search and by *signature tables* in learning?

b Explain with diagrams the major and one minor problem with *hill climbing* as a search method and suggest a way of solving each.

c Describe carefully, with an example, how *hill climbing* can be applied to *learning by search* and explain how the major problem with Hill climbing can be tackled in this case.

d Briefly discuss two further problems with *linear evaluation functions* which limit the effectiveness of learning by search and outline possible solutions.

Each part carries approximately equal marks.

End of paper