UNIVERSITY OF LONDON

291 0310W

BSc EXAMINATION

for External Students : 2005

COMPUTING AND INFORMATION SYSTEMS

CIS310 Artificial Intelligence [Western]

Duration: 2 hours 15 minutes

Date and Time: Monday, 9 May 2005 : 2.30 - 4.45 pm

There are *FIVE* questions on this paper.

Do not attempt more than *FOUR* questions. All questions carry equal marks and full marks can be obtained for complete answers to *FOUR* questions.

Questions involving a description or explanation should, wherever possible, be accompanied by an appropriate example.

THIS EXAMINATION PAPER MUST NOT BE REMOVED

FROM THE EXAMINATION ROOM

Question 1

a) Explain what it means for a search algorithm to be complete and optimal giving an example of each.

[4]

b) Using pseudocode explain the breadth first search algorithm indicating the data structure necessary for this type of search.

[8]

c) Under what conditions would this algorithm fail to finish with the goal? Give an example showing what might go wrong.

[5]

d) We seek to find a pair of integers i and j which satisfy :

$0 \leq i \leq 3 \leq j \leq 5$. and $i*j > 8$

Draw a 4 by 6 grid and mark on it the search paths taken by depth first and breadth first searches.

[8]

Question 2

a) i) Explain what is meant by 'knowledge representation'.

ii) List 4 knowledge representations that have been introduced in this course

iii) Why do we have so many representations ?

[6]

b) Distinguish between declarative and procedural knowledge, giving an example of each.

[6]

c) Explain what is meant by frames and semantic networks in the context of AI. Use examples to show their strengths and limitations.

[8]

d) Produce a semantic network describing the external London degree on which you are enrolled. [5]

Question 3

a) Using a truth table define the operations of *not, and, or* and *implies*.

[4]

b) Using a truth table, show whether or not $\neg r \vee \neg s$ is equivalent to $\neg (r \wedge s)$

[4]

c) Explain the semantic tableau method of proof, using a semantic tableau that shows whether or not

$\neg r \vee \neg q$ is a theorem of $q \rightarrow (\neg p \vee \neg r)$ and p

giving your reasons at each step for the conclusions that you make.

[12]

d) Represent the following sentences within Predicate Calculus, giving a glossary of the symbols used.

i) All creatures are great or small.

ii) No dog is cold.

iii) Every man is a piece of the continent.

[5]

Question 4

a) The understanding of natural language has been divided into: i) *phonological analysis*, ii) *morphological analysis*, iii) *syntactic analysis*, iv) *semantic analysis* and v) *pragmatic analysis*. Describe each of these stages giving examples where appropriate.

[10]

b) Define a simple grammar that generates the following sentences:

The man spoke.

Every door is locked.

[4]

c) Add semantic annotations to your grammar and derive the semantics for the two sentences in b) above using λ-calculus.

[3]

d) Add rules to your grammar allowing for transitive verbs and sentences such as: *The man kicked the ball.*

[3]

e) Translate the sentence, *Every man kicked a ball,* using λ-calculus, into a formula of the first-order predicate calculus on the basis of a syntax tree for the sentence.

[5]

Question 5

a) What are the goals of Artificial Intelligence?

[3]

b) Describe what is meant by both *strong AI* and *weak AI.*

[4]

c) List 3 applications areas where you think that the performance of computers has been disappointing in their application, explaining your reasons.

[6]

d) Similarly give 3 areas or applications where in your view, computers rival the performance of human experts in that field. Explain why you believe this.

[6]

e) To what extent do the applications you gave in c) and d) above support those believing in *strong AI* or those holding *weak AI* views?

[6]

END OF EXAMINATION