UNIVERSITY OF LONDON

291 0310E

# BSc EXAMINATION

## for External Students : 2005

COMPUTING AND INFORMATION SYSTEMS

## CIS310 Artificial Intelligence [Eastern]

Duration: 2 hours 15 minutes

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

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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 the criteria used to compare search strategies.

[6]

b) Using pseudocode explain the depth 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.

[3]

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

$0 \leq i, j \leq 6$. and $i*j > 8$

Draw a 7 by 7 grid and mark on it the search paths taken by depth first and breadth first searches starting with i and j both zero.

[8]

Question 2

a) In the context of intelligent agents, what four concepts does rationality depend upon?

[4]

b) Define the terms *agent*, *ideal rational agent* and *intelligent agent*.

[5]

c) Agent programs may be classified into *reflex agents*, *programs with internal states*, *goal-based agents* and *utility-based agents*. Explain each of these terms giving examples where possible.

[12]

d) The Cassini Huygens mission to Saturn and Titan provides a good example of where an agent based system might be useful. Explain why an agent is needed and give an appraisal of such a system's environment using the classification of environments given in the course.

[4]

Question 3

a) Using a truth table define the operations of *and*, *or*, *xor* and *implies*.

[4]

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

[4]

c) Explain the semantic tableau method of proof.

[4]

d) Using a semantic tableau show whether or not :

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

giving your reasons for the conclusions that you make.

[8]

e) Represent the following sentences within predicate calculus, giving a glossary of the symbols used.

i) All that glistens is not gold.

ii) Every cloud has a silver lining.

iii) No man is an island.

[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 and show the derivation tree for each:

*A dog barked.*

*Every cat hunts.*

[4]

c) Add semantic annotations to your grammar in b) 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: *A dog chased a cat.*

[3]

e) Translate the sentence, *Every cat chased a dog* 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 rivals that of human experts in that field. Explain why you believe this.

[6]

d) Similarly give 3 areas or applications where you think that computers have been disappointing in their application, explaining your view.

[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**