THIS PAPER IS NOT TO BE REMOVED FROM THE EXAMINATION HALLS

UNIVERSITY OF LONDON **291 0310 ZA**

BSc Examination
for External Students

COMPUTING AND INFORMATION SYSTEMS AND CREATIVE COMPUTING

Artificial Intelligence

Dateline: Friday 8 May 2009 : 10.00 – 12.15 pm

Duration: 2 hours 15 minutes

There are five questions on this paper. Candidates should answer no 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.

Calculators are not allowed.

Q1 Throughout this question you are to use the problem of route planning where appropriate as an example to illustrate your answers.

a) Explain the idea and main concepts involved in search, making sure that you define terms such as *search space, goal branching factor, informed search, time complexity* and *optimality*.

[10]

b) Explain how the problem of route finding can be expressed as a search problem.

[5]

c) What are the essential technical requirements for a search algorithm to be useful in solving the route finding problem?

[3]

d) Using route planning as an example, describe a general algorithm for search.

[5]

e) What modifications (if any) need to be made to the general search algorithm to make it suitable for route planning in real time?

[2]

Q2

a) In the context of logic, explain the meaning of the terms: *sentence, valid, proof, completeness*.

[4]

b) Explain how truth tables can be used to prove theorems, illustrating your answer by proving that A => B is equivalent to ~(A ∧ ~B).

[5]

c) Explain how semantic tableau can be used to prove theorems.

[5]

d) What criteria would you use to decide whether using a truth table or a semantic tableau is the more appropriate method for a given example?

[4]

e) Using a semantic tableau show that 'It is the weekend' follows from

'It is either Saturday or Sunday' and

'Saturday is part of the weekend' and

'Sunday is part of the weekend'.

[5]

f) State any assumptions that you made in your answer to e) above.

[2]

Q3

a) Distinguish between progression planners and regression planners.

[4]

b) Sketch an algorithm for regression planning.

[6]

c) Comment on the relative advantages and disadvantages of progression over regression.

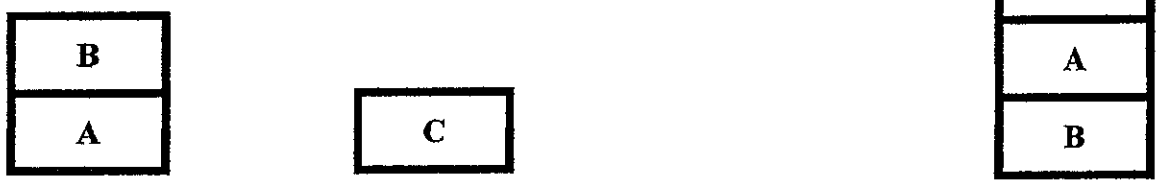
[4]

d) Distinguish between linear and non linear plans.

[4]

e) Explain how the STRIPS system would search for a plan that transforms the diagram on the left into that on the right.

[7]



Before

After

Q4 Consider the following grammar:

sentence	→	np vp
np	→	det noun
vp	→	verb
vp	→	verb-trans np
det	→	'a'
det	→	'every'
noun	→	'car'
noun	→	'man'
noun	→	'woman'
noun	→	'bonnet'
noun	→	'wheel'
verb-trans	→	'has'
verb	→	'opens'
verb	→	'drives'

a) How would one estimate the number of sentences that are defined by the grammar above?

[2]

b) List the types of ambiguity that occur in natural language.

[2]

c) Give one example of each of the following types of sentence defined by the grammar above:

i) a sentence that is likely to be true

ii) a sentence that is almost certainly false

iii) an ambiguous sentence, together with two meanings.

[3]

d) Give a parse tree for each of the sentences in i) and ii) above.

[2]

e) Explain the meaning of 'attribute-value' as used when describing grammars.

[4]

f) Show what might be added to the grammar above to make it an attribute-value grammar.

[4]

g) Add semantic annotations to the grammar above to show how semantic annotations can be used to give meaning to sentences.

[4]

h) Give a sentence, its parse tree(s) and semantic analysis to illustrate the occurrence of quantifier scope ambiguity.

[4]

Q5 In this question you are required to use the knowledge of AI applications and developments gained whilst studying this course.

a) Describe the application or development that you feel is most likely to have the largest impact in the future. Give reasons for your choice.

[10]

b) Evaluate the development using arguments similar to those of Turing, Searle and their followers.

[10]

c) Giving reasons and examples from your experience, answer the question: 'Is AI alive and well after almost a decade of the 21st century'?

[5]

END OF EXAMINATION