

BSc EXAMINATION

for External Students : 2008

2910310 Artificial Intelligence [Eastern]

Duration: 2 hours 15 minutes

Date and Time: Thursday 22 May 2008: 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**

Q1 The recommended course text has the following sketch for general search algorithm:

```
function GENERAL-SEARCH(problem, Queuing-Function) returns a solution, or failure
nodes ← MAKE-QUEUE(MAKE-NODE(initial-state[problem]))
loop do
    if nodes is empty then return failure
    node ← REMOVE-FRONT(nodes)
    if GOAL-TEST[problem] applied to STATE(node) succeeds then return node
    nodes ← Queuing-Function(nodes, EXPAND(node, OPERATORS[problem]))
end
```

Adapted from Figure 3.10 The general search algorithm. (Note that Queuing-Function is a variable whose value will be a function.) [Russell and Norvig]

- a) Briefly describe what each line of this algorithm achieves. [5]
- b) Distinguish between uniform cost search and breadth first search giving the relative advantages of each. [6]
- c) Sketch the algorithms required to be added to GENERAL-SEARCH, to perform these two searches. [4]
- d) Define the terms: *branching factor*, *informed search*, *space complexity*, *time complexity*, *optimality* and *completeness* and explain how they apply to each search described in b) above. [10]

Q2

- a) Write down the truth tables for: negation, implication and conjunction. [6]
- b) Using a truth table prove the following $\sim(A \& B) \sim A \vee \sim B$ [6]
- c) What does it mean for a sentence to be a theorem? [2]
- d) What word is used to describe a logic for which: Theorems \subseteq Valid sentences? [1]
- e) Using examples where appropriate, compare and contrast Propositional Calculus and First Order Predicate Calculus. [10]

Q3

- a) 'An *agent* perceives its *environment* through *sensors* –which give rise to *percepts* – and acts on the environment through *effectors*.'

Define the terms in italics in the above quotation and say how these terms apply when the agent is an air conditioning unit.

[8]

- b) Discuss the role of externally provided performance measures in the rationality of an agent.

[4]

- c) Explain the concepts *reflex agent* and *goal-based agent* in the context of agents.

[4]

- d) An agent's environment may be described as *accessible* and *deterministic*. Explain these terms giving examples of agents and such environments.

[4]

- e) What alternatives are there to the use of agents and what advantages and/or disadvantages do these alternatives have?

[5]

Q4 There are generally thought to be 5 levels or stages of analysis used in Natural Language understanding. For each of the 5 levels describe, using examples of language that you might find in an AI text book:

- a) the problem to be solved and the general strategy adopted
- b) the representational techniques used
- c) an example of an ambiguity that may occur
- d) a major problem (other than ambiguity) faced
- e) to what extent AI has solved the problems

[25]

Q5

- a) Explain the contrasting views of Artificial Intelligence known as Strong AI and Weak AI. [4]
- b) Giving your reasons, explain which of these two views you agree with most. [3]
- c) Outline the arguments that supporters of Searle might use to support or to refute your reasoning. [9]
- d) Turing can be thought of as taking a contrary view to that of Searle. Taking the arguments of Searle that you used in c) above how might one argue against them? [9]

END OF EXAMINATION