THE UNIVERSITY OF WESTERN AUSTRALIA

Achieve International Excellence

Computer Science and Software Engineering

SEMESTER 1, 2012 EXAMINATIONS

CITS4211
Artificial Intelligence

FAMILY NAME: _____ GIVEN NAMES: _____

STUDENT ID: | | | | | | | | | SIGNATURE: _____

This Paper Contains: **5** pages **(including title page)**
Time allowed: **2 hours 10 minutes**

INSTRUCTIONS:

Answer all questions. The marks for the paper total 100.

Most questions require only brief answers – point form answers are fine.

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Q1. **Search algorithms**

(a) Define *completeness* and *optimality* as they apply to search algorithms in AI. **2 marks**

(b) Describe the operation of *depth-limited* search. **3 marks**

(c) How is depth-limited search extended to *iterative deepening*? **2 marks**

(d) Describe the operation and problems of *bidirectional* search. **3 marks**

Q2. **Informed search algorithms**

(a) What is the role of a *heuristic* in an informed search algorithm? **2 marks**

(b) Describe how the algorithm *A** ranks nodes for expansion. **3 marks**

(c) Describe what it means for a heuristic to be *admissible*. **2 marks**

(d) Describe with an example how using an inadmissible heuristic in A* can cause a sub-optimal goal to be chosen. **3 marks**

Q3. **Game-playing algorithms**

(a) Describe the two principal sources of *incompleteness* in AI problems. **2 marks**

(b) Describe the three usual approaches for dealing with incompleteness. **3 marks**

(c) Describe the operation of the *minimax* algorithm. **3 marks**

(d) Describe how α-β *pruning* improves the performance of minimax. **2 marks**

Q4. **Learning agents**

(a) Describe the four basic components of a *learning AI agent*, and their roles. **4 marks**

(b) Describe the general operation of *inductive learning*. **3 marks**

(c) Given a large set of examples for an AI problem, how are they best deployed for developing a learning agent? **3 marks**

Q5. **Sequential decision problems**

(a) Describe what is meant by a *sequential decision problem* (SDP). **2 marks**

(b) What is a *policy* in the context of an SDP? **3 marks**

(c) What is the *transition model* in the context of an SDP? **2 marks**

(d) Describe generally how the transition model and the step cost of an SDP are likely to affect the optimal policy. **3 marks**

Q6. **Reinforcement learning**

(a) What is the principal difference between *reinforcement learning* and *supervised learning*? **2 marks**

(b) Describe the operation of *temporal difference learning*. **4 marks**

(c) What is an *optimistic prior* in the context of reinforcement learning? **2 marks**

(d) How does an optimistic prior encourage exploration by an agent? **2 marks**

Q7. **Planning**

(a) What is meant by *subgoaling* in a planning algorithm? **2 marks**

(b) What is the principal advantage of subgoaling? **2 marks**

(c) What is the *qualification problem* for a planning algorithm? **2 marks**

(d) What is the principal problem with using *conditional planning*? **2 marks**

(e) What is the main alternative to conditional planning? **2 marks**

Q8. **Logical agents**

(a) What does it mean if a knowledge base *entails* a logical sentence? **2 marks**

(b) What is the usual way of checking entailment? **2 marks**

(c) Define with an example the *resolution* rule for performing inference. **3 marks**

(d) Argue informally that resolution is *sound*. **3 marks**

Q9. **First-order logic**

(a) Describe the two principal enhancements in *first-order logic* (FOL) relative to propositional logic. **2 marks**

(b) Give an example of an English statement that can be captured in FOL but that is difficult to say in propositional logic. **2 marks**

(c) Describe with an example what it means to *unify* two FOL sentences. **4 marks**

(d) What inference rule is used in the *Prolog* programming language? **2 marks**

Q10. **Knowledge engineering**

(a) What is the fundamental trade-off in the use of logics in AI? **4 marks**

(b) How is the trade-off resolved in the design of *temporal logics*? **3 marks**

(c) How is the trade-off resolved in the design of *description logics*? **3 marks**

END OF PAPER
