THE UNIVERSITY OF WESTERN AUSTRALIA

Achieve International Excellence

Computer Science and Software Engineering

SEMESTER 1, 2013 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 90.

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

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Q1. **Search algorithms**

(a) Describe the operation of *breadth-first* search, and its performance characteristics. **3 marks**

(b) Describe the operation of *depth-first* search, and its performance characteristics. **3 marks**

(c) Describe the operation of *bidirectional search*. **2 marks**

(d) Argue whether breadth-first or depth-first search is more likely to be useful in bidirectional search. **2 marks**

Q2. **Informed search algorithms**

(a) What is the fundamental difference between an *informed* search algorithm and an *uninformed* one? **3 marks**

(b) Describe what it means for a heuristic to be *admissible*, and what it means for one heuristic to *dominate* another. **3 marks**

(c) Given two admissible heuristics for a problem, neither of which dominates the other, how can they both be usefully deployed? **2 marks**

(d) Describe with an example the *pathmax* modification to an informed search algorithm. **2 marks**

Q3. **Game-playing algorithms**

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

(b) Describe two ways that incompleteness can arise in game-playing AI. **2 marks**

(c) A game-playing AI usually has to make a move within a certain time limit. How does *iterative deepening* help with this issue? **2 marks**

(d) What is meant by *look-ahead* in the context of game-playing AI? **2 marks**

(e) Why is look-ahead less important in a dice-rolling game like backgammon? **2 marks**

Q4. **Learning agents**

(a) What is the principal role of the *problem generator* in a learning AI agent? **2 marks**

(b) What is the principle of *Ockham's razor*, used in learning agents? **2 marks**

(c) What is meant by *exploitation* and *exploration* in the context of learning agents? **2 marks**

(d) What is the principal source of tension between exploitation and exploration, and how is it usually resolved? **2 marks**

(e) What is meant by *generalisation* in the context of learning agents? **2 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? **2 marks**

(c) Describe the *policy iteration* algorithm for solving SDPs. **4 marks**

(d) Why does policy iteration often converge faster than value iteration? **2 marks**

Q6. **Reinforcement learning**

(a) Define and contrast *reinforcement learning* and *supervised learning*. **3 marks**

(b) Define and contrast *passive learning* and *active learning*. **3 marks**

(c) Describe the technique of *temporal difference learning* (TDL). **2 marks**

(d) What is the role of the *learning rate* in TDL, and why is it often set to decrease over time? **2 marks**

Q7. **Planning**

(a) Describe how a *partial-order planner* works. **4 marks**

(b) Operationally, what are the two principal ways in which a partial-order planner can fail, and what would be the planner's response to each? **3 marks**

(c) Describe what is meant by *situated planning*. **3 marks**

Q8. **Logical agents**

(a) Define the terms *sound* and *complete* in the context of an inference system. **2 marks**

(b) Explain with an example the distinction between *implication* and *causation*. **3 marks**

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

(d) Argue informally that resolution is complete for propositional logic. **2 marks**

Q9. **First-order logic**

(a) Describe the principal limitation of propositional logic relative to *first-order logic* (FOL). **2 marks**

(b) Give an example of an English statement that can be captured easily 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) Describe the *frame* problem in the context of knowledge representation. **2 marks**

END OF PAPER
