THE UNIVERSITY OF WESTERN AUSTRALIA

Achieve International Excellence

Computer Science and Software Engineering

SEMESTER 1, 2014 EXAMINATIONS

CITS3001
Algorithms, Agents and Artificial Intelligence

FAMILY NAME:_____ GIVEN NAMES: _____

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

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

INSTRUCTIONS:

Answer all questions. Each question is worth 10 marks. The total for the paper is 100.

Most questions require only brief answers: point form answers are fine where appropriate.

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Q1. String algorithms

(a) What are the **two** features that a problem must have if we want to use *dynamic programming* in its solution? **2 marks**

(b) Define the *longest common subsequence problem*, and describe how it fits the dynamic programming model. **3 marks**

(c) Illustrate how a dynamic programming solution to LCS would work for the strings *011* and *110*. **5 marks**

Q2. Optimisation algorithms

(a) What is the defining principle behind *greedy algorithms*? **2 marks**

(b) What is the principle behind *iterative improvement algorithms*? **3 marks**

(c) Illustrate these two principles using the *travelling salesman problem*. **5 marks**

Q3. Uninformed search

(a) Describe the difference between *breadth-first search* and *uniform-cost search*. **2 marks**

(b) Construct a simple scenario where breadth-first and uniform-cost search give different solutions. **3 marks**

(c) What is the principle behind *bidirectional search*? **2 marks**

(d) Describe **three** problem features that can cause problems for bidirectional search. **3 marks**

Q4. Informed search

(a) What is the difference between *informed search* and *uninformed search*? **2 marks**

(b) Describe how *A** uses heuristics to guide its search procedure. **3 marks**

(c) What does it mean for a heuristic to be *admissible*? Why is this important in an application of *A*?* **3 marks**

(d) What is the principle behind *Simplified Memory-bounded A**? **2 marks**

Q5. Game-playing

(a) What is meant by *incompleteness* in the context of AI? **2 marks**

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

(c) What is the role of *look-ahead* in a game-playing AI? **2 marks**

(d) What level of *look-ahead* is used in a typical evaluation function? **1 mark**

(e) Describe two reasons why a game-playing AI might vary the level of look-ahead used across its game tree. **2 marks**

Q6. Sequential decision problems (SDPs)

(a) What is the role of a *policy* in the context of an SDP? **2 marks**

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

(c) Describe in general terms how the optimal policy for a problem varies with the details of the transition model. **2 marks**

(d) Describe the operation of the *policy iteration* algorithm for solving SDPs. **4 marks**

Q7. Learning agents

(a) What are the **four** basic components of a learning AI agent? **4 marks**

(b) What are the **four** main connections between these components? **4 marks**

(c) What is *inductive learning*? **2 marks**

Q8. Reinforcement learning

(a) What is the difference between *passive learning* and *active learning*? **2 marks**

(b) Describe the operational behaviour of *temporal-difference learning*. **3 marks**

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

(d) What is the conflict between exploration and exploitation, and how is it usually resolved? **3 marks**

Q9. Logical agents

(a) Define the *resolution principle* in the context of propositional logic. **2 marks**

(b) Describe and illustrate with an example the main way in which *first-order logic* is more expressive than propositional logic. **3 marks**

(c) What is the *frame problem* in the context of logical agents? **2 marks**

(d) Describe and illustrate with an example what it means to *unify* two sentences in first-order logic. **3 marks**

Q10. Planning and acting

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

(b) What are the **two** principal sources of *uncertainty* for planning agents? **2 marks**

(c) What are the **two** principal ways that planning agents deal with *uncertainty*? **4 marks**

END OF PAPER