CITS3001 Mid-semester Test 2018

Semester 2

Fifty minutes

Answer all three questions

Total marks 30

Name:_____

Student Number: _____

When showing the operation of an algorithm, include enough detail to make it clear that you understand how *the algorithm* solves the problem.

Answer all questions in the spaces provided in the booklets.

Question 1: Optimisation (10 marks)

a) Define what it means for a problem to be *NP-complete* and give an example of an NP-complete problem.

3 marks

b) Define the term *Dynamic Programming* and give an example of a dynamic programming algorithm.

2 marks

c) Define the term *Greedy Algorithm* and give an example of a problem that can be solved by a greedy algorithm

2 marks

d) What is meant by a *Gradient-Based Search Algorithm.* Describe one technique that allows gradient based search to escape local optima.

3 marks

Question 2: Search (10 marks)

The *fifteen puzzle* consists of 15 tiles arranged in a 4 by 4 grid. Any tile next to the empty cell can slide into the empty cell, and the tiles are numbered from 1 to 15. The aim of the game is to slide the tiles about the board until they are in order.

a) What is the best uninformed search strategy to find the fastest solution to the puzzle.
2 marks

b) Justify your answer to (a) in terms of Optimality, Completeness, Memory and Time.
3 marks

c) In applying the A* algorithm to the fifteen puzzle, we could apply the following heuristics:

a. h1 is the number of tiles out of place
b. h2 is the sum of the rectilinear distances from each tile to its correct place
c. h3 is the sum of the numbers on the tiles that are out of place

For each heuristic, state whether it is *admissable* and *monotonic* and whether it *dominates any other heuristic.* Explain your answer.

5 marks

Question 3: Game-Playing (10 marks)

Alice and Bob have just started dating, and they have agreed to the following protocol to sharing costs. They keep track of how much money each has spent on their dates, and whoever has spent the least (in total) will pick up the next bill. Also, whoever is paying for the date can chose the next activity they will do.

For example, this week Alice and Bob will go for dinner ($120), go to the movies ($65), have lunch ($60) and go the the zoo ($45). Bob could pay for dinner, then Alice could pay for movies and lunch, and the Bob would pay for the zoo, so Bob pays $165 and Alice pays $125.

a) Alice and Bob are very pragmatic (and not sure about their future together), so they are aiming to minimise costs. Given that they will do a fixed set of activities, each with a fixed cost, describe the scenario as a two-player game.

4 marks

b) Given the activities: dinner ($150); lunch ($60); and theatre ($110), apply the minimax algorithm.

4 marks

c) Using your answer to (b), explain how alpha-beta pruning can reduce the number of nodes that need to be explored.

2 marks

Extra page

Extra page