Introduction to AI. Midterm

Notes

- You agree with the following: All of the answers here are your own. If ANY answer is not yours and is largely taken from a different source, you will receive a zero for the whole quiz.

- You must turn in a PDF (not word, not zip, not text) with your answers typed (and drawn when necessary) using a computer. Hand written/drawn portions will receive a discount.

- Graduate students grade is out of 120 pts. Undergraduate scores out of 100pts.

1 Given the following two tables, Trace and show your work to find the best route from Valparaiso to Santiago using A* search . (10 pts.)

Given these two tables:

City 1	City 2	Distance in Km.
Valparaiso	Viña	9
Viña	Casablanca	48
Valparaiso	San Antonio	88
San Antonio	Melipilla	48
Melipilla	Santiago	73
Casablanca	Santiago	78

Table 1: Distances from pairs of adjacent cities in Chile.

City	Distance in Km.
Valparaiso	100
Viña	102
San Antonio	90
Melipilla	70
Casablanca	78

Table 2: Straight line distances from cities in Chile to Santiago

2 Express these system specifications using the propositions p: "The user enters a valid password," q: "access is granted" and r: "the user has paid the subscription fee" and logical connectives (including negation).. (20 pts.)

- "The user has paid the subscription fee , but has not entered a valid password"

- "Access is granted whenever the user has paid the subscription fee and enters a valid password"

- "Access is denied if the user has not paid the subscription fee"

- "If the user has not entered a valid password and has paid the subscription fee, then access is granted"

3 Indicate whether the statements below are true or false and write a sentence about your reasoning, or a counter example if appropriate.. (10 pts.)

- If b is the branching factor and d the maximum depth of a search tree that finds a solution: The space complexity of the depth-first search is $O(b^d)$

- Expectiminimax is better in stochastic enviroments when compared to minimax.

- The MRV heuristics considers the variables involved in most constraints to be selected next.

- Hill-Climbing always finds a valid solution to a search problem.

- A CSP with n variables with domain size d has $n!d^n$ leaves.

- Simulated Annealing is at least as efficient as random restarts

4 Given the game board and game specifications below, answer the following questions. (20 pts.)

-10	5	15
10	-16	-5

Table 3: Game board associated with this question

In the game associated with the board above, there are two players: black and white. Each player gets exactly one move. Each square has a value, as specified in the figure. First black moves and then white moves. Black is allowed to place their piece on any one of the six squares. White then places their piece on a square, however white must play on a square such that their piece is not adjacent to black (horizontally or vertically only). For example, if black plays on 5, then white cannot play on 15, -16 or -10. When a piece is played on a square, that square's value is added to the total score. At the end of the game, black wins if the score is positive and white wins if it is zero or negative.

- Draw the game tree according to the game's sepcifications. Black makes the first move.

- Specify the minimax value for each node

- What choice would Black make when following the minimax algorithm and why?

- Indicate which nodes would be prunned by alpha-beta prunning assuming the search goes from left to right.

5 An agent that solves crossword puzzles has a list with all possible words. Every state is a crossword puzzle that can be empty, has some words in it, or be complete. Each action places a word in the puzzle. Check the answers that better describe the environment. (10 pts.)

- Partially observable or fully observable?

- Single or multi agent?

- deterministic or stochastic?

- discrete or continuous?

6 Constraint Satisfaction. (10 pts.)

Given the following puzzle:

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        T   W   O
   -    O   N   E
      ─────────────
        O   N   E
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1. State the CSP formally in terms of variables and constraints

2. Solve the puzzle using backtracking, forward looking and MRV. Write down each step you take and mention whether you backtrack, assign a value, perform forward checking or choose an MRV. State your solution clearly.

7 Given the following knowledge base, answer the question: Does the tooth fairy exist? show your work by formalizing the problem in propositional logic. (20 pts.)

If the tooth fairy were able and willing to give money she would do so. If the tooth fairy were unable to give money she would be powerless; If she were unwilling to give money, she would be mean;The tooth fairy does not give money. If the tooth fairy exists she would not be powerless nor mean.

8 In a casino, you find a slot machine. Each wheel is independent and produces one of the four symbols (d c s h) with equal probability.. (20 pts.)

The slot machine has the following payout scheme for a bet of $1 (where ? denotes that we don't care what comes up for that wheel):Â

- ddd pays $20

- ccc pays $15

- sss pays $5

- hhh pays $3

- hh? pays $2

- h?? pays $1

Compute the expected payback for the slot machine. The expected payback is computed by multiplying the probability of each winning outcome by its monetary value and then adding those values. But be careful not to count some outcomes twice.

Write down your answer approximating to two decimals.