CS444 - Artificial Intelligence- Sample Exam 1
February 2019

James MadisonUniversity
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Abidement by the Honor Code:

I abide by the guidelines of the honor code at JMU.

Signature: _____

Instructions:

- Do not proceed with the exam until directed to do so.
- You have a total of 70 minutes (2:05 pm - 3:15 pm).
- The exam is closed book.
- Write your answers in the space provided. If you need more space, you can write on the back of the page. Should you need more space, blank pages are provided for you at the end.
- Do not spend a lot of time on a particular problem. Read all problems first. Then, attack them in the order that you think allows you to accumulate most points.
- You will be graded on both correctness and clarity. Show your work but be concise!
  Points will be deducted for rambling.

Name: _____

[Do not write in this space!]

Exercise	1	2	3	4	5	6	7	8	9	10	11	TOTAL
Max Nr. Pts	10	5	5	10	13	5	10	10	10	12	10	100
Your Score												/100

1. Here is a simplified version of the missions and cannibals problem. Two missionaries and two cannibals are on one side of the river along with a boat that can hold one or two people. Find a way to get everyone to the other wide of a river without ever leaving a group if missionaries in one place outnumbered by the cannibals in that place. This is a famous AI problem (Amarel, 1968).

   (a) Formulate the problem, only including items required to compute the solution. Draw a diagram of the state space. [5 pts]

   (b) implement and solve optimally using an appropriate search algorithm. Comment on the need to check for repeated states.

2. The following implementation of graph search may be incorrect.

```
function GRAPH-SEARCH(problem, fringe)
    closed ← an empty set,
    fringe ← INSERT(MAKE-NODE(INITIAL-STATE[problem]), fringe)
    loop
        if fringe is empty then
            return failure
        end if
        node ← REMOVE-FRONT(fringe)
        IF GOAL-TEST(problem,STATE[node]) THEN
            RETURN node
        END IF
        ADD STATE[node] TO closed
        fringe ← INSERTALL(EXPAND(node, problem), fringe)
    END LOOP
END FUNCTION
```

Circle all the problems with the code. [5pts]

(a) Nodes may be expanded twice.

(b) Nodes may be expanded twice.

(c) The algorithm is no longer complete.

(d) The algorithm is no longer complete.

(e) The algorithm could return an incorrect solution.

(f) None of the above.

3. Let h* = the number of misplaced tiles in the 8-puzzle game.

   (a) Show that h* is an admissible heuristic. [2 pts]

   (b) Trace A* with the h* heuristic to solve the 8-puzzle starting from the following configuration ('-' indicates blank tile): [5 pts]

   2 4 3
   1 6 8
   5 - 7

4. Answer the following questions concisely.

(a) Most game-playing programs do not save search results from one move to the next. Instead, they usually start completely afresh whenever it is the machine's turn to move. Why? [3 pts]

5. Consider a simpler version of NIM's game: Place a number of tokens between two opponents; at each move, the player whose turn comes must divide a pile of tokens into two non-empty piles of different sizes. The first player who can no longer make a move loses the game.

   (a) Start with a pile of 7 tokens with the MIN player making the first move. Show game tree and solution path. [5 pts]

   (b) Use alpha-beta pruning to show what nodes would not need to be examined in above game tree. [5 pts]

Blank page [write name and nr. of problem you are solving here.] Name_____