Name: _____

CptS 440/540 – Artificial Intelligence
Fall 2017

Exam I

September 28, 2017, 9:10am-10:25am

Duration: 75 minutes

Instructions: Clearly write your name at the top of this exam. Complete all problems on this exam. Write all your work on this exam; you may use the backs of pages if needed. The exam is closed book, closed notes, and closed neighbor. No electronic devices are allowed, except your own calculator. Failure to turn in your exam at the end of 75 minutes will result in deduction of points. Anyone cheating on the exam will receive a zero.

Problem	Points Possible	Your Score
1	10	
2	12	
3	16	
4	12	
5	12	
6	12	
7	1	
Total	75	

1. (10 points) Short answer.

   a. (2 points) Of the four approaches to AI below, which one are we pursuing in this course? (circle your answer)

      i. Acting humanly

      ii. Thinking humanly

      iii. Thinking rationally

      iv. Acting rationally

   b. (2 points) Which of the following best describes a computer passing the Turing test? (circle your answer)

      i. The computer takes this exam and achieves a passing grade.

      ii. The computer convinces a human judge that it is human.

      iii. The computer composes music that humans actually like.

      iv. The computer can beat the best human player at chess.

   c. (4 points) For each of the task environment properties below, give an example of a game that exhibits this property.

      i. Fully-observable.

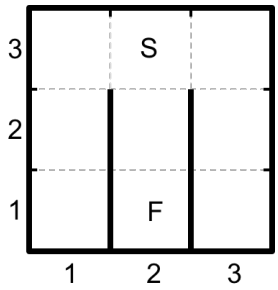
      ii. Partially-observable.

      iii. Stochastic.

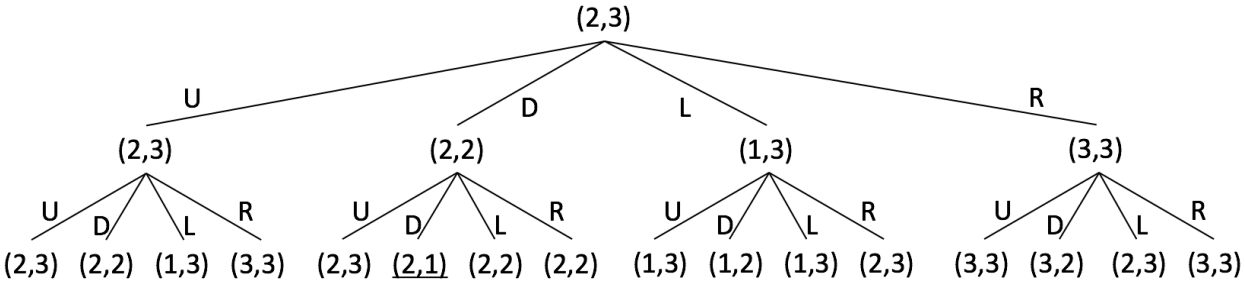
      iv. Dynamic.

   d. (2 points) Give an example of a rule that a reflex agent might use in the Wumpus World.

2. (12 points) Consider the following maze problem, which is the same as in the homework, except for a different starting location. The agent's goal is to move from the start location S in (2,3) to the finish location F in (2,1). There are four moves that are available at each location (Up, Down, Left, Right), each with a cost of 1. If a move bumps into a wall (thick black line), then the agent will stay in the same location, but still incur a cost of 1.



Below is the complete search tree to a depth of 2 for this problem.

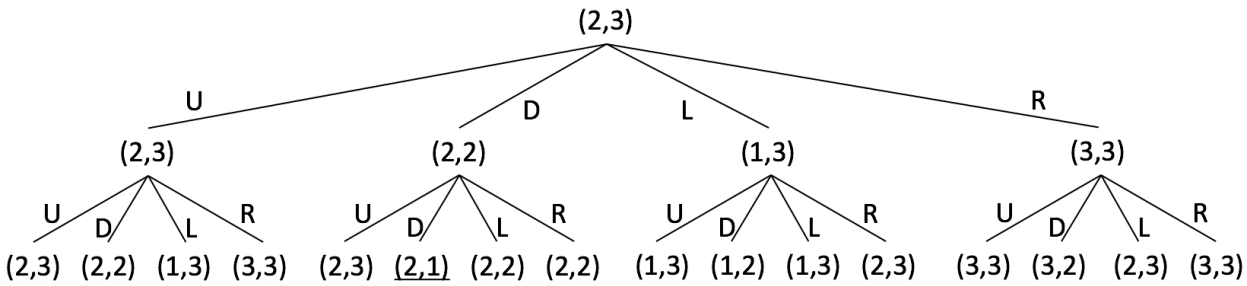


a. (5 points) Applying breadth-first search to this problem, draw an X over each node that would not be generated; and expand the tree to show any nodes that are generated, but not shown.

b. (3 points) Would depth-first tree search terminate on this search problem? Justify your answer.

c. (4 points) How many nodes would be generated applying iterative-deepening search to this problem? Show your work.

3. (16 points) Below is the same search tree from problem 2. Perform A* search on this problem using the city-block distance heuristic.



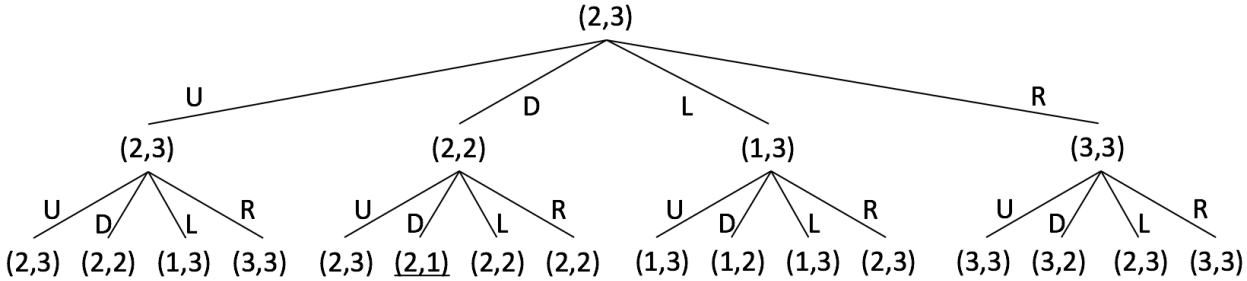
a. (5 points) Draw an X over each node that would not be generated; and expand the tree to show any nodes that are generated, but not shown.

b. (5 points) Show the values of *f*, *g* and *h* next to each node that is generated.

c. (3 points) Is the city-block heuristic admissible? Justify your answer.

d. (3 points) Suppose we change the heuristic to be twice the city-block distance. Would this heuristic be admissible? Justify your answer.

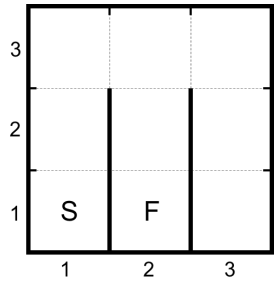
4. (12 points) Below is the same search tree from problem 2. Perform hill-climbing search on this problem, where the value of a node is 1 / (*c* + 1), where *c* = the node's city-block distance to the goal.



a. (6 points) Draw an X over each node that would not be generated; and expand the tree to show any nodes that are generated, but not shown.

b. (6 points) Show the value next to each node that is generated.

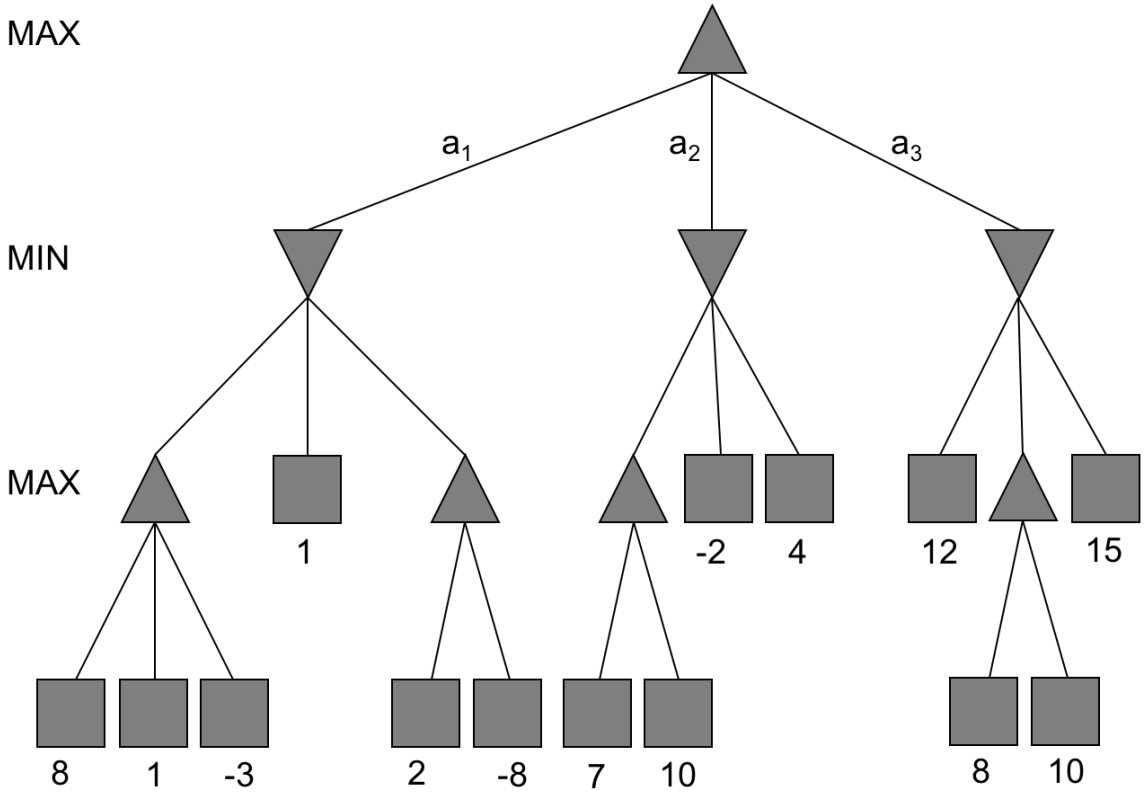
5. (12 points) Consider the maze problem from problem 2, but with the start location of (1,1), as shown below.



   a. (10 points) Draw the search tree generated by hill-climbing search using the same value as in Problem 4; namely, value = 1 / (*c* + 1), where *c* = the nodes's city-block distance to the goal. Show the value next to each node that is generated.

   b. (2 points) What state is returned by hill-climbing search for this problem?

6. (12 points) Perform alpha-beta pruning on the following tree. Upward-pointing triangles are MAX nodes, downward-pointing triangles are MIN nodes, and squares are terminal nodes.
   - Put an "X" over each node that is pruned, i.e., not evaluated (including all nodes in a pruned subtree).
   - Put the final value next to all other nodes.
   - Indicate which action MAX should take: a_1, a_2 or a_3.



7. (1 point) Several leaders from industry and academy have warned that AI is a threat to humanity. Do you agree?. (circle your answer; either answer receives full credit).

   a. Yes.

   b. No.