

Exam I

October 1, 2020, 9:10am-10:25am, Pacific time

Note: The Fall 2021 exam will all be administered as a Quiz on Canvas.

1. Short answer questions.

- a. For each task property below, indicate one of the two options that applies to the Wumpus World.

- | | | | |
|------|------------------|-----|----------------------|
| i. | Fully-observable | vs. | Partially-observable |
| ii. | Single-agent | vs. | Multi-agent |
| iii. | Deterministic | vs. | Stochastic |
| iv. | Episodic | vs. | Sequential |
| v. | Static | vs. | Dynamic |
| vi. | Discrete | vs. | Continuous |

- b. What is the branching factor for the search problem corresponding to the Wumpus World?
- c. Describe an admissible heuristic for the search problem corresponding to the Wumpus World?

2. More short answer questions.

- a. What does it mean for a search algorithm to be complete?
- b. Describe a search algorithm, and any necessary constraints, such that the search algorithm is both complete and optimal.
- c. What is the time complexity of breadth-first search for a search problem with branching factor b and optimal solution depth d ?
- d. Of the four approaches to AI discussed in class, which approach is the one we are pursuing in this course?

3. Consider the following initial and goal states for a 3x3 Wumpus World search problem. The initial state has the agent in (1,2) facing Right, and the goal state is that the agent is in (3,2), co-located with the gold, regardless of orientation. The available actions are GoForward (GF), TurnLeft (TL), and TurnRight (TR), and should be considered in this order.

		W
A→		G
		P

Initial State

		W
		AG
		P

Goal State

- a. Draw the search tree showing all nodes generated by the Breadth-First Search algorithm, as described in the lecture notes, to solve this problem. Each node should be drawn as a 3x3 grid like the above initial and goal states.

- b. How many total nodes are generated using Iterative-Deepening Search to solve this problem?

4. Consider the same 3x3 Wumpus World search problem described in question 5. The same initial and goal states are copied below.

		W
A→		G
		P

Initial State

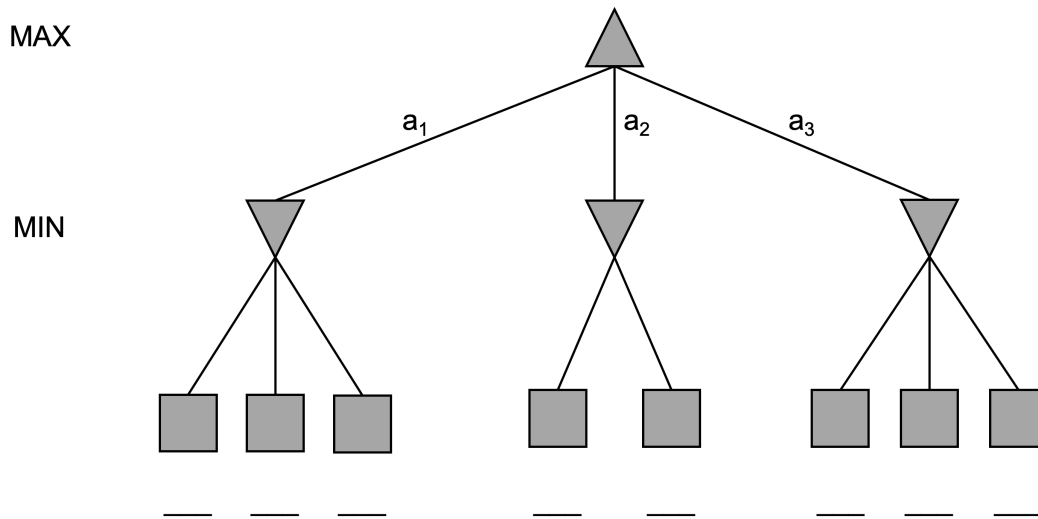
		W
		AG
		P

Goal State

Draw the search tree generated by the A* search algorithm, as described in the lecture notes, to solve this problem using the city-block distance for the heuristic h . The city-block distance for a Wumpus World state is the city-block distance between the agent's current location and the agent's goal location. Next to every node, show the values of f , g and h . Each node should be drawn as a 3x3 grid like the above initial and goal states.

5. Game tree search.

- a. In the 8 blanks provided below the terminal nodes, enter the last 8 digits of your WSU ID # in **increasing sorted order** from left to right. Perform Minimax-Search on the resulting game tree below. Put the value next to each node. Indicate which action MAX should take: a_1 , a_2 or a_3 .



- b. In the 8 blanks provided below the terminal nodes, enter the last 8 digits of your WSU ID # in **decreasing sorted order** from left to right. Perform Alpha-Beta-Search on the resulting game tree below. 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 .

