

Washington State University
School of Electrical Engineering and Computer Science
Fall 2020

CptS 440/540 Artificial Intelligence

Homework 4

Due: September 24, 2020 (11:59pm pacific time)

General Instructions: Put your answers to the following problems into a PDF document and submit as an attachment under Content → Homework 4 for the course CptS 440 Pullman (all sections of CptS 440 and 540 are merged under the CptS 440 Pullman section) on the Blackboard Learn system by the above deadline. Note that you may submit multiple times, but we will only grade the most recent entry submitted before the deadline.

1. Consider the following initial and goal states for a 3x3 Wumpus World search problem. The initial state has the agent in (1,1) facing Right, and the goal state is that the agent in (1,2), co-located with the gold, regardless of orientation. The available actions are **GOFORWARD**, **TURNLEFT** and **TURNRIGHT**, and should be considered in this order. Note that all three actions are applicable in every state. Executing **GOFORWARD** when facing a wall results in the same state.

		W
G		
A→		P

Initial State

		W
AG		
		P

Goal State

Draw the search tree generated by the **A* search algorithm** 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 . If two nodes have the same f value, then prefer nodes farther to the left in the search tree.

2. Consider the game tree below. **Upward-pointing triangles are MAX nodes**, **downward-pointing triangles are MIN nodes**, and **squares are terminal nodes**.
 - a. Perform **Minimax-Decision search** on the above tree. Put the final value next to each node in the tree. Finally, indicate which action MAX should take: a_1 , a_2 or a_3 .
 - b. Perform **Alpha-Beta-Search** on the above tree (don't reuse your tree from part (a)). Put an "X" over all nodes (internal and terminal, and all nodes in a subtree) that are pruned, i.e., not evaluated. Put the final value next to all non-pruned nodes. Finally, indicate which action MAX should take: a_1 , a_2 or a_3 .
 - c. *540 students only*. Consider the last five terminal leaf nodes in the above tree with utilities 8, 9, 4, 5, 6. If you could change these utilities to any value between 1 and 9, what values would you use in order to maximize the number of nodes pruned by the **Alpha-Beta-Search**. Show this tree and perform Alpha-Beta-Search on this tree in the same way as described in part (b).

