Learning Objectives

- To practice running minimax search and alpha-beta pruning.
- To evaluate the properties of a real-world example of adversarial search.

Q1. Adversarial Search

Observe the minimax graph below.

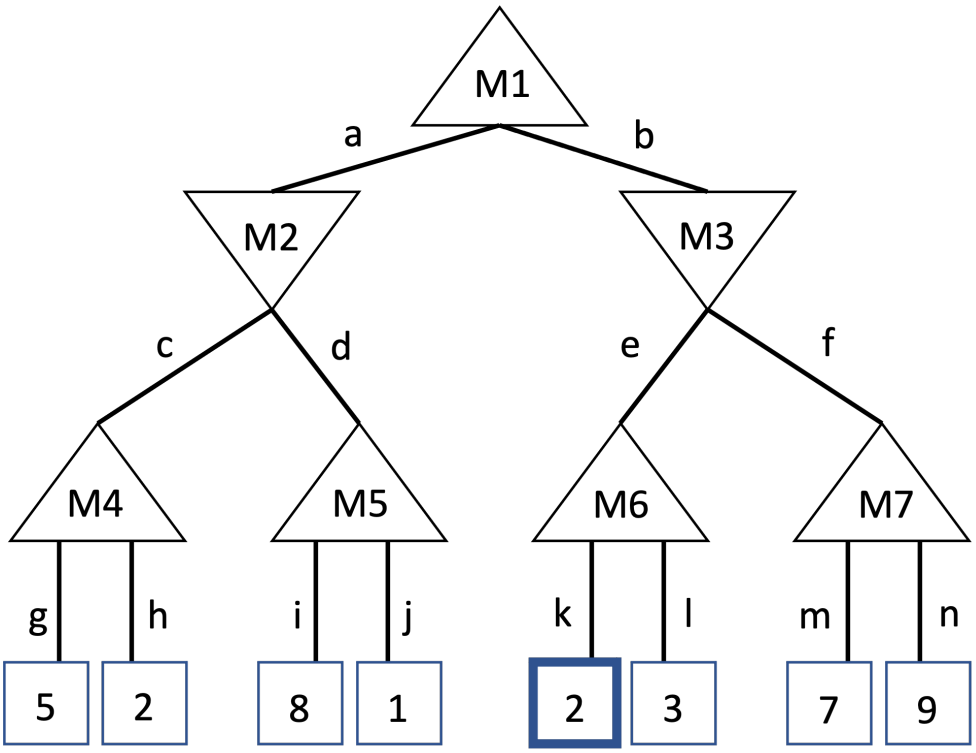

Figure 1: Graph

(a) What is the minimax value of the root (M1)?

(b) What is the smallest integer value could you change the highlighted 2 to change the value of M1?

(c) With the original 2 in place again, what edges would be pruned in alpha-beta pruning?

Q2. Connect 4

Connect Four is a two player game in which players take turns dropping colored discs into a column of a 6 row by 7 column grid. The discs stop at the lowest open row in the column. The first player with 4 of their colored discs to appear consecutively (horizontally, vertically, or diagonally) wins.

Figure 2: Connect 4 game

(a) You decide to model each player as an agent. Is the game static or dynamic? Is it stochastic or deterministic? Is it fully observable or partially observable?

(b) What is the maximum branching factor for each agent? What is the minimum branching factor?

(c) What is the maximum depth of the search tree?

(d) Is it feasible to search through the whole minimax tree to find a best move? If not, what kinds of heuristics could you create to value a non-leaf node?

(e) Is the minimax algorithm still optimal if you used a heuristic to value non-leaf nodes?