

Assignment 4 Comprehension

B351 / Q351

Due: October 8, 2019 @ 11:59PM

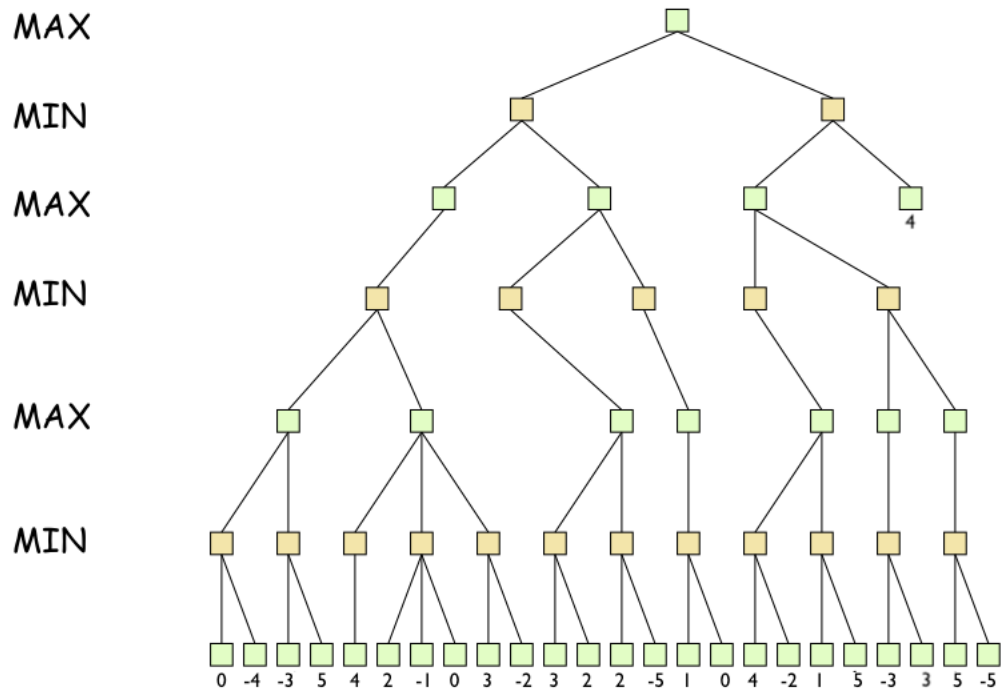
On α - β pruning

- Suppose you have performed α - β pruning on a game tree with horizon h where you used a static evaluation function $f(x)$ to estimate how good the positions at the horizon h are. Now you realized that you made a mistake when computing $f(x)$ and that a better heuristic is actually given by

$$g(x) = \begin{cases} (f(x))^2 & \text{if } f(x) \geq 0 \text{ and} \\ -(f(x))^2 & \text{if } f(x) < 0 \end{cases}.$$

How does this change in heuristic affect the previous pruning? Carefully justify your answer.

- For the tree below, write down the α - β value of each of the nodes that are NOT pruned in α - β pruning.



- For the same tree as in the previous question, what sequence of moves in the tree correspond to optimal play? Indicate the path in the tree.

4. Draw an example of a game tree (this tree does not have to be associated to a particular game) of depth 3 and branching factor 2 where α - β pruning will NOT prune anything.

Thinking about a simple game

5. Consider the following game played on a $1 \times N$ board: Two players take turns writing on the board. Each player can place an S or an O, and the first player who produces three consecutive boxes that spell SOS wins the game. For example, if $N = 3$ a possible game is as follows:

The first player writes an S in the first square, so the game is at position

S _ _

The second player places an S in the last square, so the game is at position

S _ S

[this is not a very smart move, by the way]

The first player places an O in the second square, so the game is at position

S O S

(so the first player wins).

- (a) Suppose that the first player places an S in the first square and that $N = 4$. Was this a good move? Justify your answer.
- (b) Who wins the game if $N = 7$? (the possibilities are the first player, the second player, or a draw. You must assume the players are playing to win!) Justify your answer.

Bonus question 10%

6. Consider the heuristic function for the 8-puzzle given by: $h(s) =$ sum of permutation inversions. For example, $h(N) = 4+6+3+1+0+2+0+0 = 16$ (there are 4 numbers smaller than 5 that come after 5, 6 numbers smaller than 8 that come after 8, and so on) for the following board configuration N :

5		8
4	2	1
7	3	6

STATE(N)

Is h admissible? Justify your answer with a proof or counterexample.