



Artificial Intelligence

Assignment 7

Assignment due by: 13.12.2017, Discussion: 15.12.2017

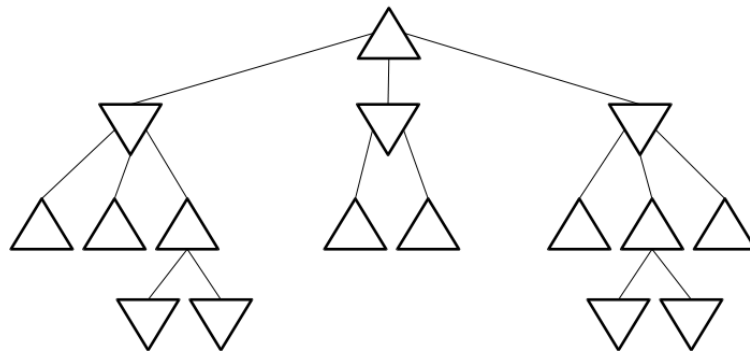
Question 1 Minimax (3+2+1=6 points)

Two players, MAX and MIN, are playing a game against each other with two heaps of three wooden matches each. Each player can remove one or two matches from a single heap per round. The player who removes the last match loses the game. MAX plays first.

- (a) Build the entire search tree for the game. Hint: do not use numbers for heaps and matches, this will simplify the tree.
- (b) Set leaf values to 1 when MAX is winning and -1 when MIN is winning. Derive minimax values for all nodes.
- (c) Is there an optimal strategy for one of the two players? If yes, which?

Question 2 Alpha-beta pruning I (2+2+2=6 points)

Consider the following search tree:



- (a) Distribute integers from 1 to 10 on the leaves of the tree so that alpha-beta pruning does not prune a single leaf. Explain the choice of your distribution.
- (b) Distribute integers from 1 to 10 on the leaves of the tree so that alpha-beta pruning prunes as many leaves as possible. Explain the choice of your distribution.
- (c) Draw a binary minimax game tree (which needs not be full or balanced) with ten leaf nodes for which alpha-beta pruning prunes as many nodes as possible. Indicate which nodes are pruned.

Question 3 Alpha-beta pruning II (3+5=8 points)

The search tree shown in Appendix A is the representation of a game, where MAX should make a move. Therefore:

- (a) Write down the minimax values for each node. Which path should MAX choose?
- (b) Apply the alpha-beta pruning algorithm to fill in the information on each node. You should identify when and which values (v , α , β) should be written down. Which parts of the tree do get pruned and why?