Foundations of Artificial Intelligence

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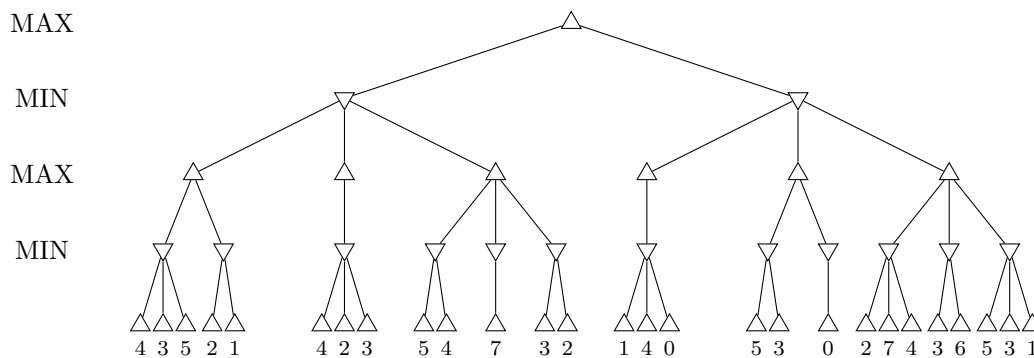J. Seipp, S. Sievers   Computer Science
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Exercise Sheet 12
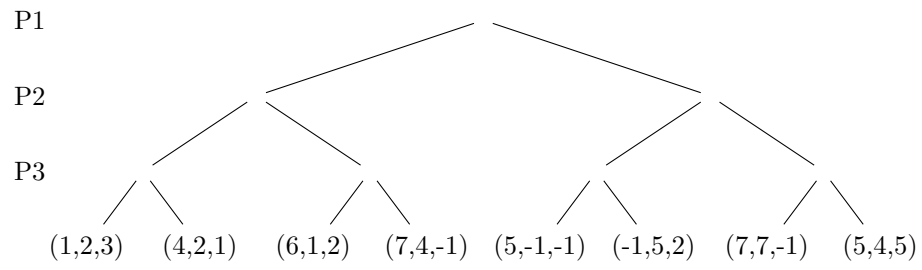### Due: May 24, 2017

Exercise 12.1 (2+3+5 marks)

Consider the following game tree:

(a) Use the minimax algorithm to annotate the game tree. Successor nodes should be considered from left to right. According to the values computed by the minimax algorithm, what is a possible playout of the game tree?

(b) Use alpha-beta search for the game tree. As for part a), successor nodes should be considered from left to right. As a solution for this part, draw the pruned game tree (i.e., only the nodes that are considered by the algorithm) and annotate all nodes with the alpha and beta values (as they are when the algorithm terminates). How many nodes does alpha-beta search need to consider? Discuss the difference compared to part (a).

(c) Can you reorder the game tree (without altering the game) such that alpha-beta search can prune even more nodes, i.e., the resulting game tree is even smaller than in part b)? If so, draw the reordered game tree and again annotate it with alpha and beta values and show which parts of the tree can be pruned (e.g. by drawing cut lines through edges which lead to subtrees that do not need to be considered). How many nodes does alpha-beta search need to consider, how many does it prune? How does this compare to part b)?

Exercise 12.2 (2 marks)

Consider an extension of the concept of game trees to three players, where the game is not necessarily zero-sum. We assume that there are no alliances allowed between any players. The players are now called P1, P2, and P3. In contrast to two player zero-sum games, the evaluation of a position now is a triple (x_1, x_2, x_3), where x_i is the reward for player i and all players aim to maximize their reward. Annotate all inner nodes of the following game tree with triples containing the maximum reward for reachable for each player under the assumption that all players play perfect. Mark the best moves.

P1

P2

P3

(1,2,3)   (4,2,1)   (6,1,2)   (7,4,-1)   (5,-1,-1)   (-1,5,2)   (7,7,-1)   (5,4,5)

Important: The exercise sheets can be submitted in groups of two students. Please provide both student names on the submission.