Foundations of Artificial Intelligence
Summer term 2002

University of Freiburg
De Raedt / Kersting

Exercise Sheet No 5

May 15, 2002

Deadline: May 29, 2002, before the lecture

1 bonus point

Exercise 5.1

*SMA** abandons paths (setting f-value ∞) that fill up memory by themselves but do not contain a solution. Show that without this check, *SMA** will get stuck in an infinite loop whenever it does not have enough memory for the shortest solution path. (Hint: Are nodes with f-value ∞ expanded?). (3 points)

Exercise 5.2

1. Perform the minimax algorithm in the tree in Figure 1 using $\alpha\beta$-pruning. Traverse the tree from left to right. (5 points)

2. Can the nodes be ordered in such a way that $\alpha\beta$-pruning can cut off more branches? If so, give the order. Otherwise, argue why not. (3 points)

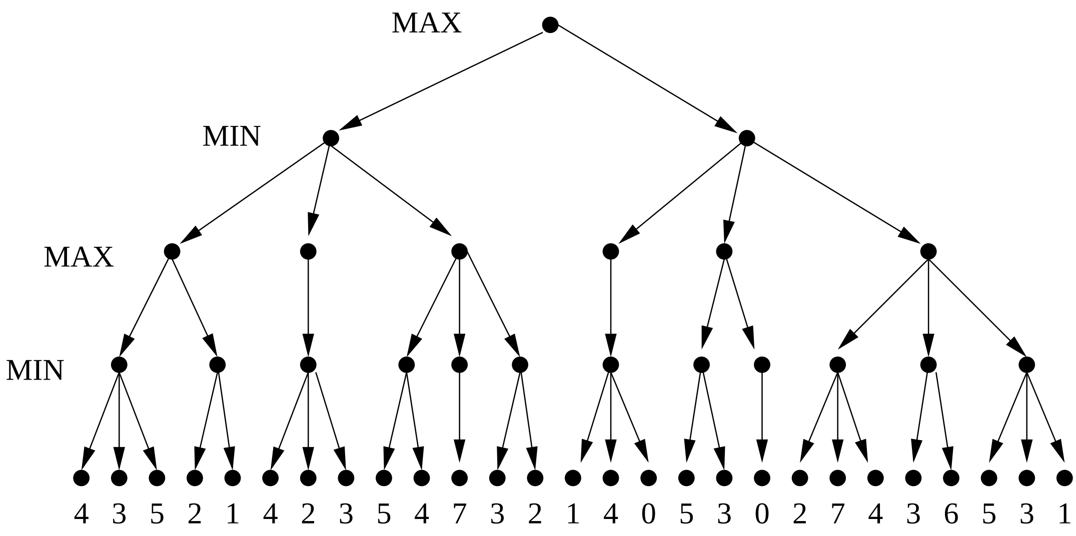

Abbildung 1: The tree in which $\alpha\beta$-pruning should be performed. Traverse the tree from left to right.

Exercise 5.3

Let $\mathcal{T}$ be the set of all finite minimax game trees. Assume that no utility functions are given, i.e. the terminal nodes are not scored.

1. Give an algorithm that assigns to each terminal node in a tree $T \in \mathcal{T}$ a utility value such that $\alpha\beta$-search cannot prune any branches of T (i.e. $\alpha\beta$-search reduces to ordinary minimax). (3 points)

2. Prove that your algorithm is correct.
(Hint: What is the invariant of $\alpha\beta$-search?) (1 point)

Exercise 5.4 (5 points)

Let us consider the problem of search in a three-player game. (You can assume no alliances are allowed for now.) We will call the players 0, 1 and 2 for convenience. The first change is that the evalutation function will return a list of three values, indicating (say) the likelihood of winning for players 0, 1 and 2, respectively. Complete the game tree shown in Figure 2 by filling in the backed-up value triples for all remaining nodes, including the root. Explain your answer.

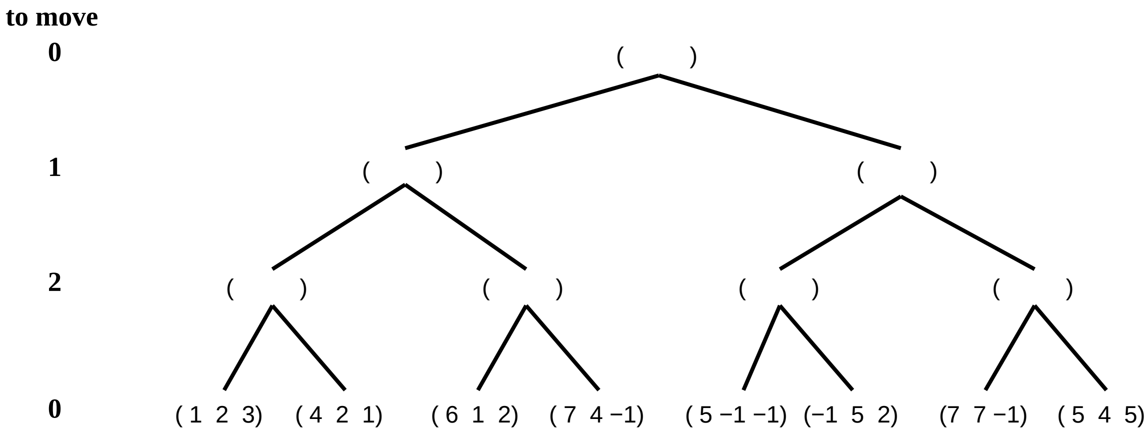

Abbildung 2: The first three ply of a game tree with three players (0, 1 and 2).