Session 4: Minimax and Constraint Processing

1. Perform the minimax algorithm on the tree in figure 1, first without and later with $\alpha\beta$-pruning. Can the nodes be ordered in such a way that $\alpha\beta$-pruning can cut off more branches ?

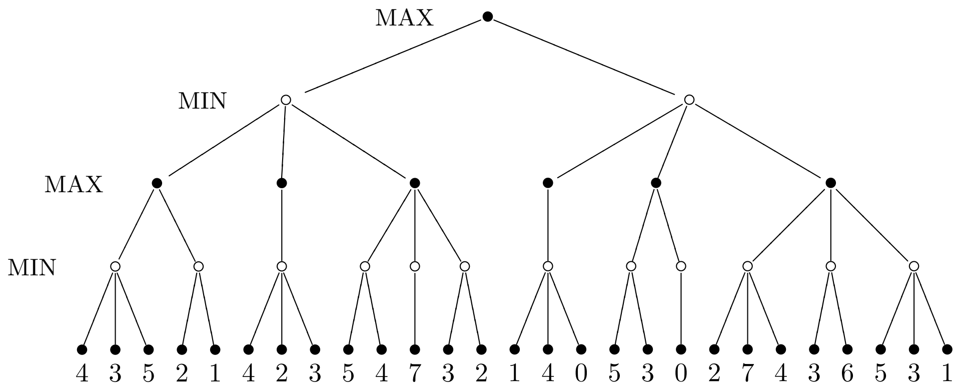
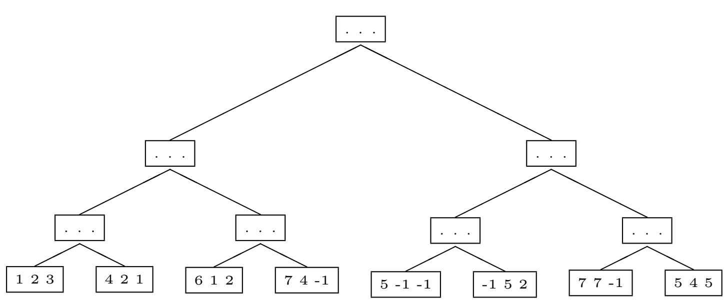


Figure 1: Minimax problem

2. Try to come up with a reformulation of minimax algorithm that works when three players are involved. Apply your algorithm on the figure below, where each node shows the score for each of the three players.



3. Consider the following variant of the 4 houses problem:

   - There are 4 families A, B, C and D living in 4 different houses, numbered 1, 2, 3 and 4.
   - C lives in a house with a higher number than the house in which D lives.
   - D lives next to A, in a house with a lower number.
   - There is at least one house between the houses of D and B.
   - C does not live in the house with number 3.
   - B does not live in the house with number 1.

   Which family lives in which house? Solve the problem using backtracking, backjumping and backmarking.

   Now consider the following sets of assignments: $\{A = 1\}$, $\{A = 2, B = 2\}$, $\{A = 2, B = 3\}$, $\{A = 2, B = 3, C = 1\}$, $\{A = 2, B = 4\}$. Which of these are "no-goods" ? (You can use arc-consistency based arguments to determine whether or not they are.)

   Assume that an "intelligent backtracking" algorithm has the actual no-goods from the list above as well as the following available: $\{A = 3, B = 2\}$, $\{A = 3, B = 4\}$, $\{A = 4, B = 2\}$, $\{A = 4, B = 3\}$, $\{A = 4, C = 2\}$. Trace the OR-tree built up by the intelligent backtracking algorithm, based on standard backtracking (i.e. the fixed order of the variables is A, B, C and D; the assignments are done in the order 1, 2, 3 and 4 and no domain elements are eliminated based on arc-consistency) in which nodes that contain a no-good are not visited.