

# Adversarial Search Review

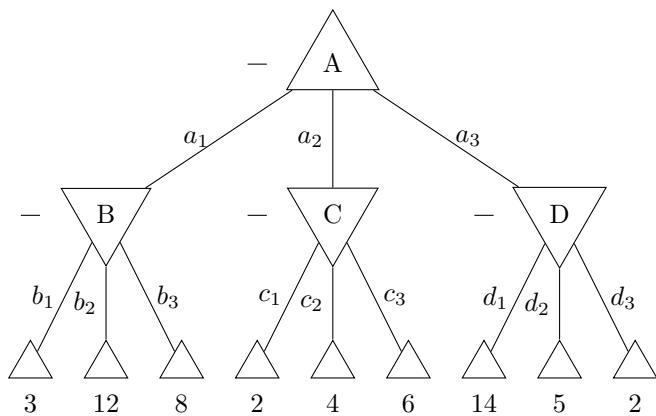
## Artificial Intelligence

1. What is a zero-sum game?

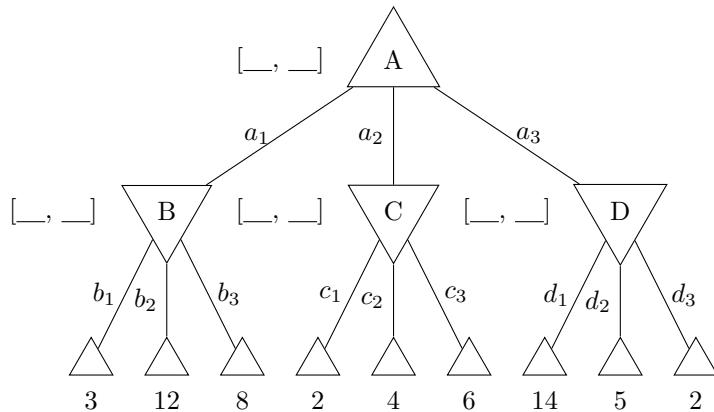
2. What is another, perhaps better, term for zero-sum? Why?

3. What is a ply?

4. In the following 2-ply minimax game tree, what are the minimax values of nodes A, B, C, and D, and which move is selected by MAX?



5. In the following game tree, what are the  $\alpha$  and  $\beta$  values in the intervals and which branches would be pruned from the tree with Alpha-Beta pruning?



6. In basic minimax search, the *Minimax* value function is defined by:

$$\text{Minimax}(s) = \begin{cases} \text{Utility}(s, \text{MAX}) & \text{if } \text{IsTerminal}(s) \\ \max_{a \in \text{Actions}(s)} \text{Minimax}(\text{Result}(s, a)) & \text{if } \text{ToMove}(s) = \text{MAX} \\ \min_{a \in \text{Actions}(s)} \text{Minimax}(\text{Result}(s, a)) & \text{if } \text{ToMove}(s) = \text{MIN} \end{cases}$$

How does the minimax algorithm and the *minimax* value function change when using a heuristic static evaluation function?

7. In terminal states, what is the value of the  $\text{Eval}(s, \text{MAX})$  function?

8. How does Monte-Carlo Tree Search differ from Heuristic Alph-Beta Search?
9. Which weaknesses of Heuristic Alph-Beta Search does MCTS seek to overcome?
10. Using the *UCB1* upper confidence bound selection policy with a low  $C$  value, which path,  $a$  or  $b$ , would MCTS expand?

