

# 50.021 – Artificial Intelligence

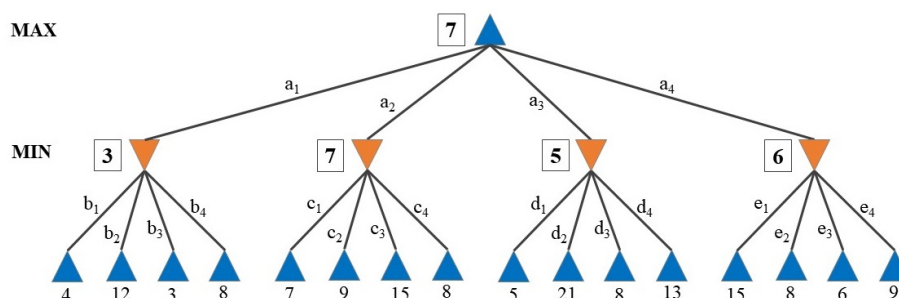
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## Week 9 Theory Homework - Adversarial/Game Search

[The following notes are compiled from various sources such as textbooks, lecture materials, Web resources and are shared for academic purposes only, intended for use by students registered for a specific course. In the interest of brevity, every source is not cited. The compiler of these notes gratefully acknowledges all such sources. ]

These answers are provided only as a brief guide. There could be more than one way to answer the questions.

### 1 Minimax Search



Consider the above game tree for a 2-ply game between two players, with the utility scores as listed. Apply the Minimax algorithm on this search, where the exploration of moves/actions is based on alphabetical order (i.e.,  $a_1, a_2, a_3, \dots$ ). Answer the following:

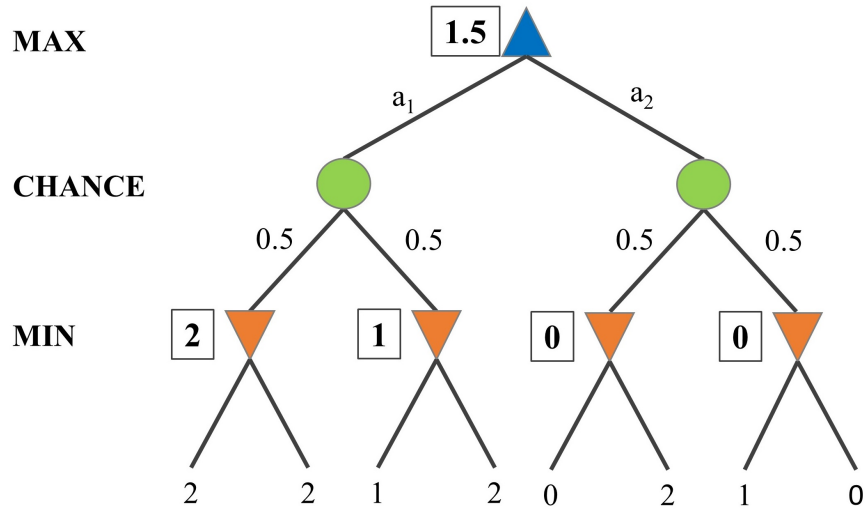
- List down the Minimax values at each level (i.e., the square boxes with the question mark). **As above**
- Briefly explain why those values are chosen. **As per the lecture and exercise examples, the minimum value among the child nodes for the MIN node, etc**
- Which move/action would be chosen?  **$a_2$**

### 2 $\alpha - \beta$ Pruning

Using the same search tree from Task 1, apply  $\alpha - \beta$  pruning with the same move ordering as before. Answer the following:

- Which moves/actions are pruned (if any)? List them in the order they were removed.  **$d_2, d_3, d_4, e_4$**
- Briefly explain why these moves/actions were removed (if any). **As per the lecture and exercise examples.**

### 3 ExpectiMinimax Search



Consider the above game tree for a probabilistic game between two players, with the utility scores as listed at the leaf nodes. In this game, there are chance nodes (denoted by circles) that are based on a fair coin toss. Apply the ExpectiMinimax algorithm on this search, where the exploration of moves/actions is based on alphabetical order. Answer the following:

- List down the ExpectiMinimax values at each level (i.e., the square boxes with the question mark). **As above.**
- Which move/action would be chosen?  **$a_1$**