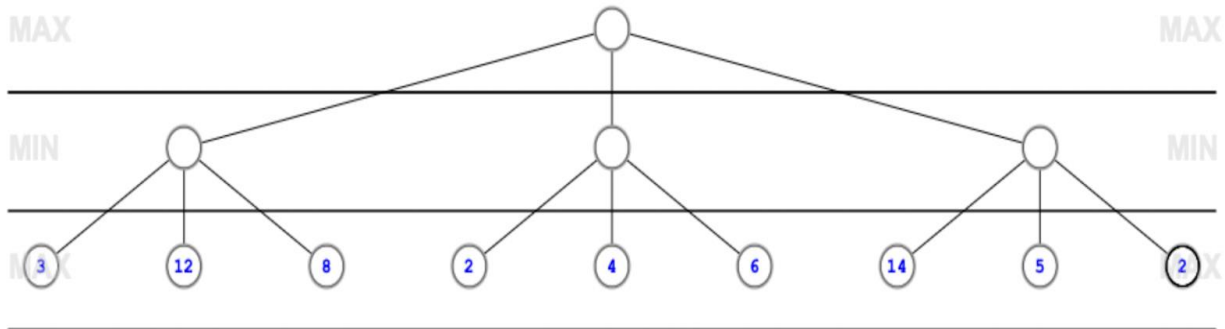*Solutions: Game Playing – Spring 2022 Final Exam (10 points)*

Mark all the correct options:

(4 points) Given the below game tree, answer the following questions (2 points each):

Simulation: http://homepage.ufp.pt/jtorres/ensino/ia/alfabeta.html

https://raphsilva.github.io/utilities/minimax_simulator/#

1.1: How many comparisons will Alpha-Beta save over Mini-Max,

(2 points) If we run the algorithm from left to right: **2**

(2 points) If we run the algorithm from right to left: **0**

Explanation: In this scenario, Alpha-Beta prunes 2 nodes and 0 nodes from right to left and left to right respectively, resulting in saving 2 and 0 comparisons, and hence the difference.

(2 points) 1.2: Which of the following statements about the time/space complexity of the Minimax algorithm is true (Mark all that apply)?

  (a) **Minimax has the same time complexity as Depth First Search**
  (b) Minimax has the same time and space complexity as Breadth First Search
  (c) Its space complexity is b^m and time complexity is b*m
  (d) **Its time complexity is b^m and space complexity is b*m**

where b is the average number of legal moves at each point and m is the maximum depth of the tree

Explanation: The formula is discussed in the lecture and available in book.

(2 points) 1.3: For which of the following reasons does Alpha Beta Pruning improve performance over Mini Max (Mark all that apply)?

(a) Increases the number of nodes checked
(b) **Decreases the number of nodes checked**
(c) Alters the order in which nodes are checked
(d) Both b and c
(e) Trick question: None of the mentioned above

Explanation: Alpha-Beta only decreases the number of nodes checked due to its pruning technique.

(2 points) 1.4: Which of the following are/is true (Mark all that apply)?

(a) An initial game state S is, by itself, sufficient to define a game tree rooted at S for a game with more than 1 state.
(b) A Zero-Sum game can be a single player game
(c) The minimax algorithm computes the minimax decision from the previous game state.
(d) **In the minimax algorithm, the recursion proceeds all the way down to the leaves of the tree, and then the minimax values are backed up through the tree as the recursion unwinds**
(e) Trick question: No options mentioned above are true

Explanation: The definition of the working of the mini max algorithm is the only correct option. All other options are vague and are not completely defined or are blatantly false.