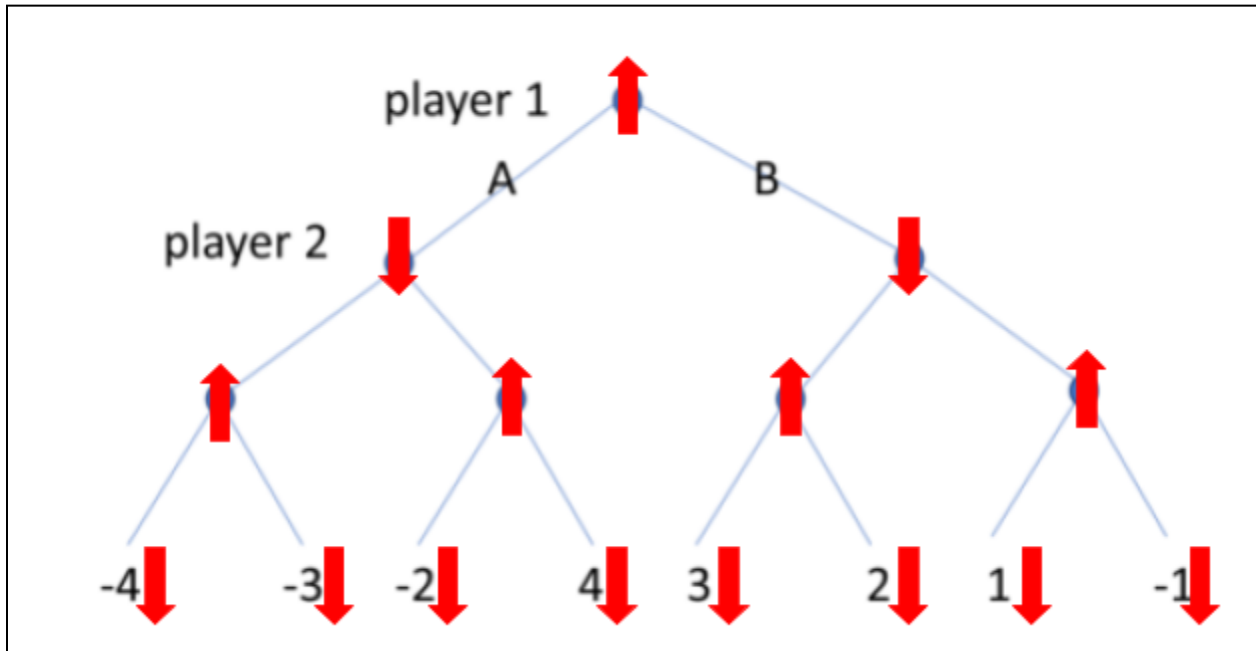
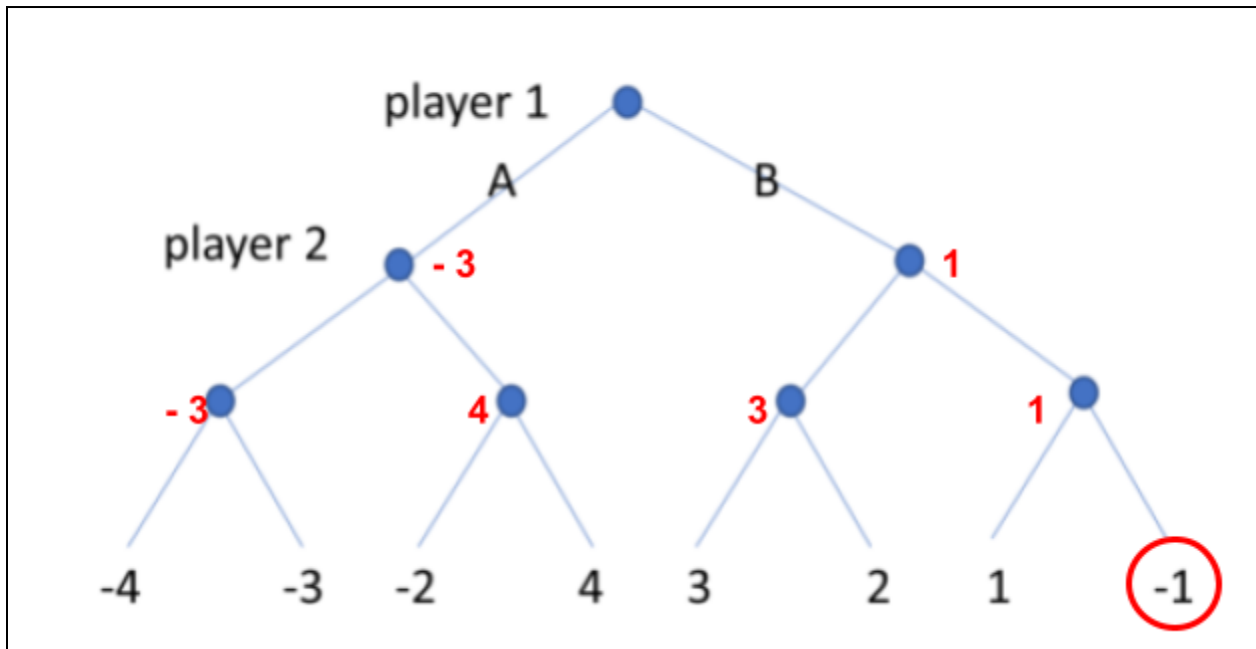


QUESTION 1:

Labeled with Arrows:

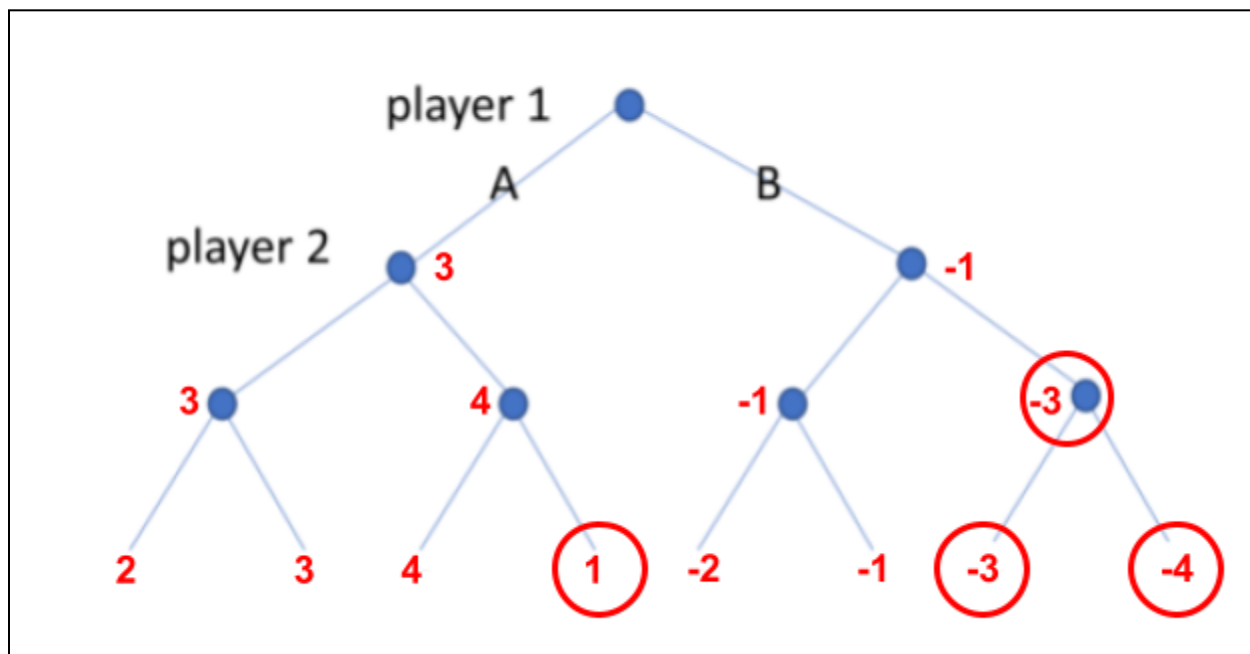


Minimax Values and Alpha-Beta Pruning on Original Tree:

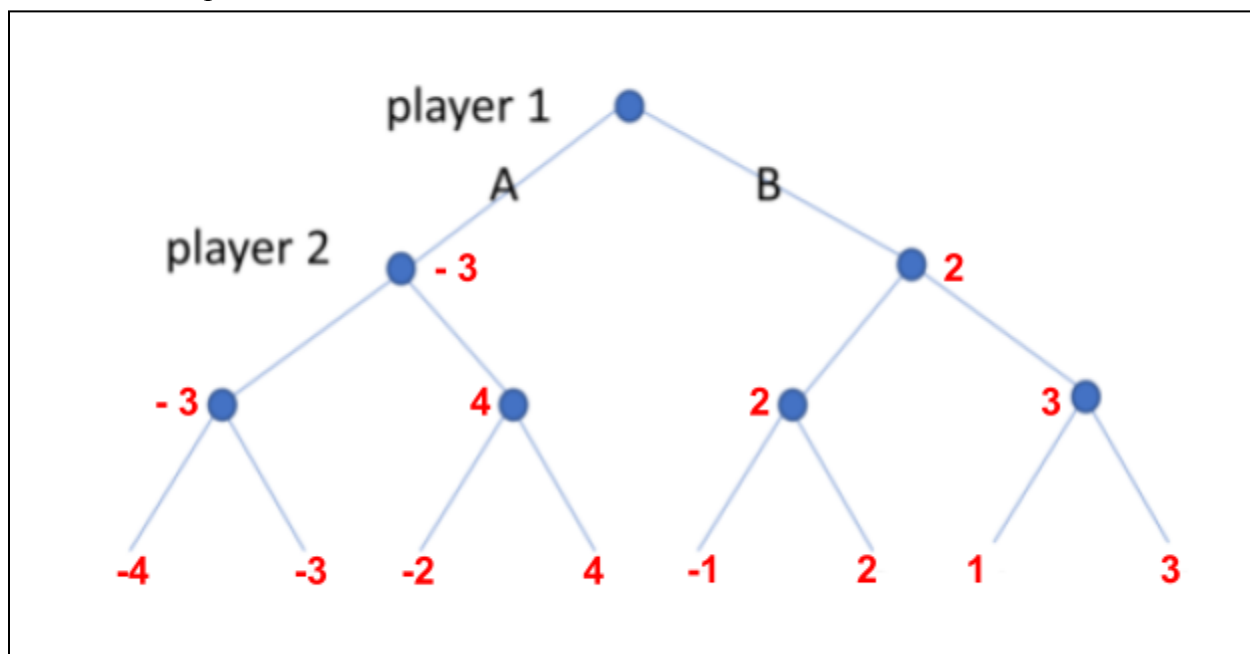


Player 1 should choose Path B with an expected outcome of +1

To maximize Alpha-Beta:



To eliminate Alpha-Beta:



QUESTION 2:

- The player at the root could never force a win, since the other player would always make the final move. It does not matter where the 2 non-zero states are.
- Given the scenario of only 2 non-zero states, and only 1 winning state for each player, it is impossible for either player to force a win, no matter where the winning states are, and no matter the depth. (except for a trivial depth of 1) Even if the states are adjacent to each other, the player who moves second-to-last would choose a draw over giving the last player the opportunity to win. If the states are not adjacent, it is also always a draw.

QUESTION 3:

a) Variables: $X(i)$ is the hiker in the (i)'th position. Where $i = 1, 2, 3$

Domains:

Each variable can be assigned to exactly one hiker:

$D(X1) = D(X2) = D(X3) = \{A, B, C\}$ (*Alex, Bob, Charlie*)

Constraints:

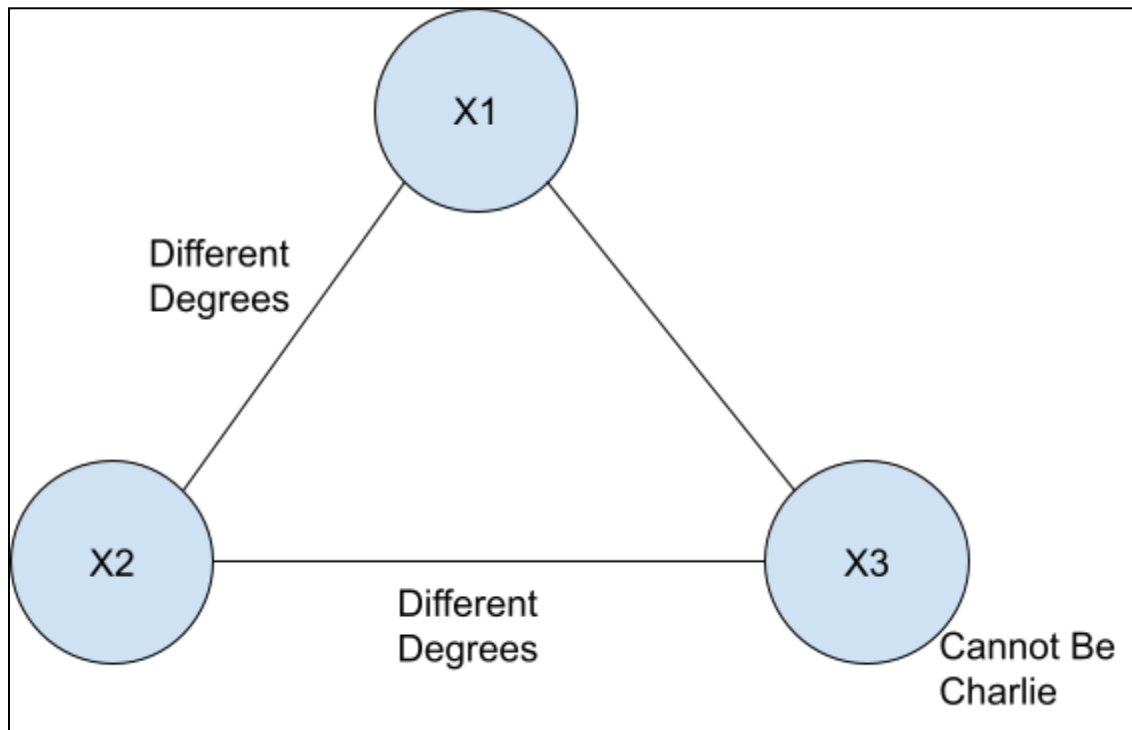
Adjacent hikers cannot have the same degree:

- (1) If $X1 = A$ then $X2 \neq C$
- (2) If $X1 = C$, then $X2 \neq A$
- (3) If $X2 = A$ then $X1 \neq C$, $X3 \neq C$,
- (4) If $X2 = C$ then $X1 \neq A$ and $X3 \neq A$

Charlies does not want to be last:

- (5) $X3 \neq C$

b)



c) Try: $X_1 = A$
Try: $X_2 = B$
Try $X_3 = C$ (*Violates Charlie last constraint (5)*)
Backtrack:
Try: $X_2 = C$ (*Violates same degree constraint (4)*)
Try: $X_1 = B$
Try: $X_2 = A$:
Try $X_3 = C$ (*Violates same degree constraint (3)*)
Backtrack:
Try: $X_2 = C$
Try $X_3 = A$ (*Violates same degree constraint (4)*)
Try: $X_1 = C$
Try: $X_2 = A$
Try $X_3 = B$ (*Violates same degree constraint (3)*)
Backtrack:
Try: $X_2 = B$
Try: $X_3 = A$ (*No violations, valid*)
Only Valid Solution: $\{X_1, X_2, X_3\} = (C, B, A)$

d) Try: $X_1 = A$
 $D(X_2) = \{B\}$
 $D(X_3) = \{B, C\}$
Try: $X_2 = B$
 $D(X_3) = \{C\}$ (*Violates Charlie last constraint (5)*)
Try $X_1 = C$
 $D(X_2) = \{B\}$
 $D(X_3) = \{A, B\}$
Try: $X_2 = B$
 $D(X_3) = \{A\}$ (*No violations, valid*)