CS 5100 - PS4

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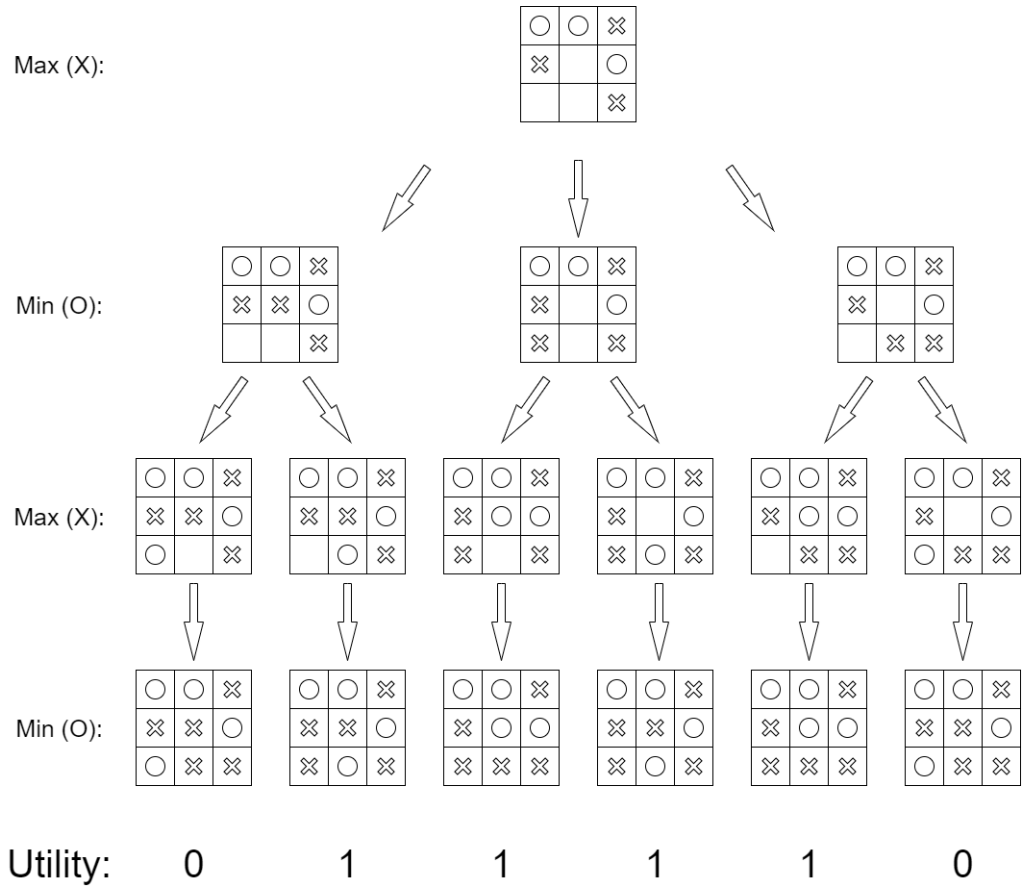
Problem 1 Expectimax: For the Expectimax tree above, what is the value of A, B, C, D, E, F, G?

A:	40
B:	28
C:	40
D:	34
E:	28
F:	44
G:	40

Extra explanation: Since we assume uniform random probabilities, for each successor of state the probability p is $\frac{1}{3}$. Hence, the value of D is $\frac{1}{3} \times 72 + \frac{1}{3} \times 21 + \frac{1}{3} \times 9 = 24 + 7 + 3 = 34$, the value of E is $\frac{1}{3} \times 28 + \frac{1}{3} \times 6 + \frac{1}{3} \times 50 = 26 + 2 = 28$, the value of F is $\frac{1}{3} \times 25 + \frac{1}{3} \times 39 + \frac{1}{3} \times 68 = 31 + 13 = 44$, and the value of G is $\frac{1}{3} \times 86 + \frac{1}{3} \times 22 + \frac{1}{3} \times 12 = 36 + 4 = 40$. Since upward triangles are max nodes and downward triangles are min nodes, the value of B should pick minimum one between the value of D and E which is 28, and the value of C is 40. Moreover, the value of A will pick the maximum one between the value of B and C which is 40.

Problem 2: Two-Player Game

1) Draw the game tree starting from the final position shown above.

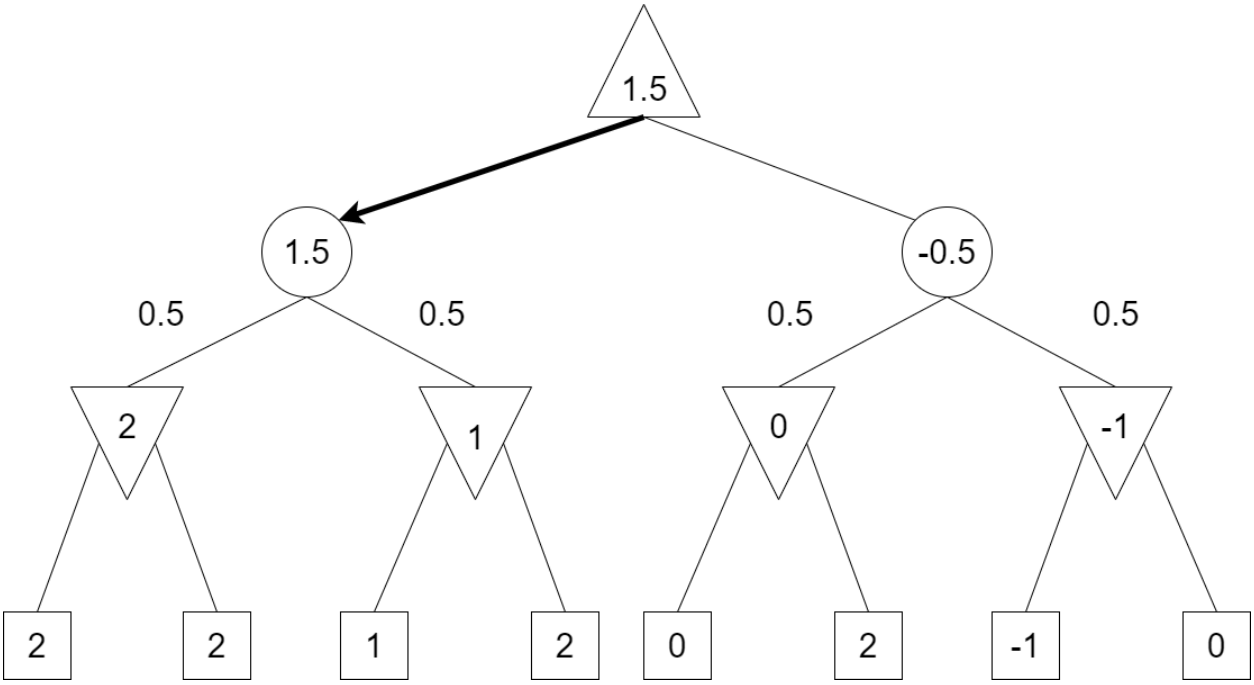


2) Does X have a winning strategy at the current (right-most) state? What should X play next?

According to the game tree diagram, we could see that as long as we make move on the lower left corner (row 3, first column), X will always win. Therefore, next play X should make move on the (third row, first column).

Problem 3: Pruning with Chance Nodes

1) In the figure, mark the value of all the internal nodes, and indicate the best move at the root with an arrow.



2) Given the values of the first six leaves, do we need to evaluate the seventh and eighth leaves? Given the values of the first seven leaves, do we need to evaluate the eighth leaf? Explain your answers.

- Given the values of first six leaves, we still need to evaluate the seventh and eighth leaves. Since the range of possible values is from -∞ to ∞, if seventh and eighth leaf both are positive value, the best move could be changed.
- However, given the values of first seven leaves, we don't need to evaluate eighth leaf. Because we've already knew the seventh leaf value if -1, no matter what value eighth leaf have, it would not worse than -1 and beast move would not be changed.

3) Suppose the leaf node values are known to lie between −2 and 2 inclusive. After the first two leaves are evaluated, what is the value range for the left-hand chance node?

Since the leaf node values lie between -2 and 2, in the worst case either the third leaf or fourth leaf (or both) would be -2 so that the chance node would be $2 \times 0.5 + (-2) \times 0.5 = 0$. Similarly, In the best case the chance node would be $2 \times 0.5 +$

$2 \times 0.5 = 2$. Therefore, the value range for the left-hand chance node must lie between 0 and 2.

4) Circle all the leaves that need not be evaluated under the assumption in (c).

(See figure below, the leaves would be circled by red color)