CSCE-420-HW1

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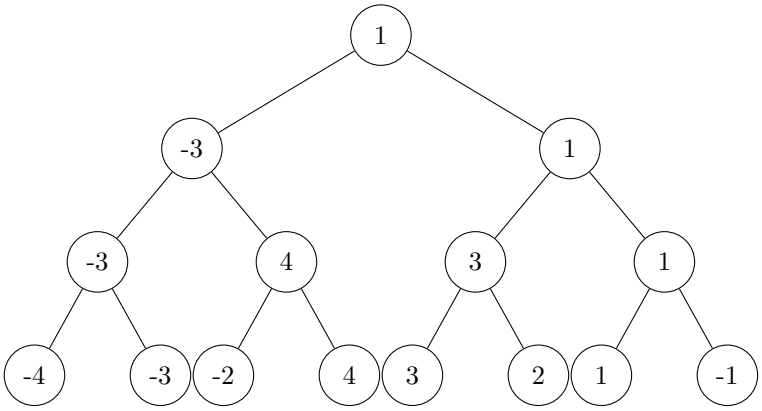
1 Question 1



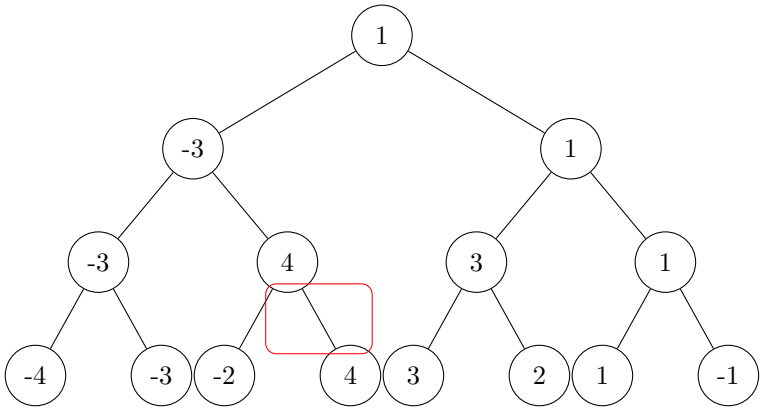
1.1 Should the player 1 take action A or B at the root?

The player 1 should take action B from the route in order to maximize the payoff at the end of the game. For action B the payoff is 1 and action A the payoff is -3.

1.2 What is the expected outcome (payoff at the end of the game)

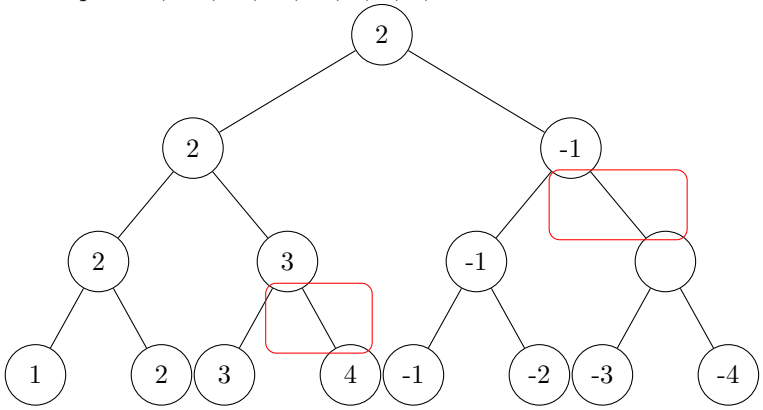
The expected outcome payoff is 1, so player 1 will win.

1.3 Which branches would be pruned by alpha-beta pruning?



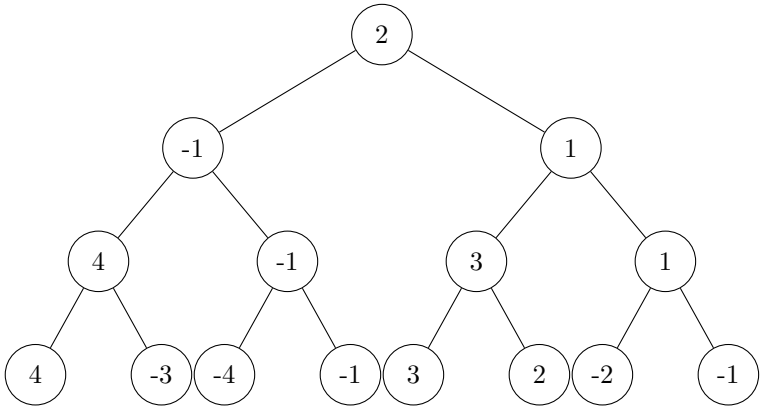
1.4 How could the leaves be relabeled to maximize the number of nodes pruned? (you can move the utilities around arbitrarily to other leaves, but you still have to use -4,-3,-2,- 1,+1,+2,+3,+4)

The leaves could be labeled in the following order to maximize the number of nodes pruned, +1,+2,+3,+4,-1,-2,-3,-4.



1.5 How could the leaves be relabeled to eliminate pruning?

The leaves could be relabled as follows to eliminate pruning, +4,-3,-3,-1,+3,+2,-2,+1.



2 Question 2

2.1 Could the player at the root force a win?

The player at the root would not be able to force a win. Being at the bottom level of tree, the winning state wouldn't be available and there would only be the utility 0 and losing state. The player at the root would have to choose from one these two options, neither of which are the winning state.

2.2 Does it matter where the 2 non-zero states are located in the tree? (e.g. adjacent or far apart)

It does not matter where the 2 non-zero states are located in the tree. The outcome for the player will still be the same because either state could be any of the leaves.

2.3 If this question was changed to have a different depth, would it change the answers to the two questions above? If yes, how do the answers change? If no, explain why no change would happen.

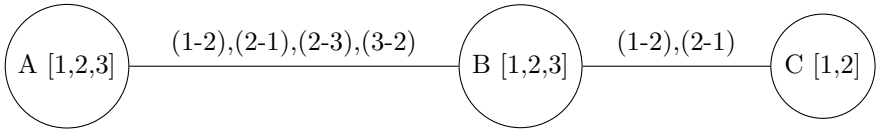
If this question was changed to have a different depth, it would change the answers to the two questions above. For the first question, if the depth was one, this would ensure that the player at the root would be able to force a win because it would be easier to pick the winning state. For the second question, unless the depth was 1 it wouldn't matter as both players would be forced to draw.

3 Question 3

3.1 Show how to set this up as a Constraint Satisfaction Problem. (what needs to be defined?)

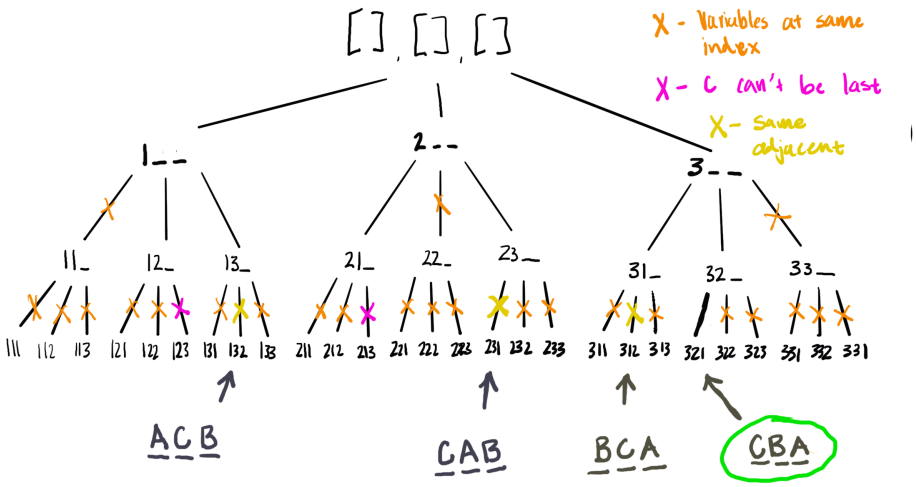
Variables: Alex (A), Bob (B), and Charlie (C)
Domain: 1, 2, and 3
Constraints: A != B, B != C, C != B, the domain of C cannot be 3, A + 1 != C, A - 1 != C

3.2 Draw the Constraint Graph (label all nodes and edges)



3.3 Trace how plain Backtracking (BT) (with no heuristics) would solve this problem, assuming values are processed in alphanumeric order. Identify instances where back-tracking happens.

Backtracking occurs when there are no more variables to choose from and no solution has been found yet. This is first seen in the image below when indexes of 1,1,? would never yield a solution as A and B can't be located at the same index. Orange X's represent where backtracking would occur.



3.4 **Trace how BT would solve this problem using the MRV heuristic.**