Paula Bezares
20393015
Eshaan Mittal
20620983

LAB 2: ADVERSARIAL GAMES

WORK DONE

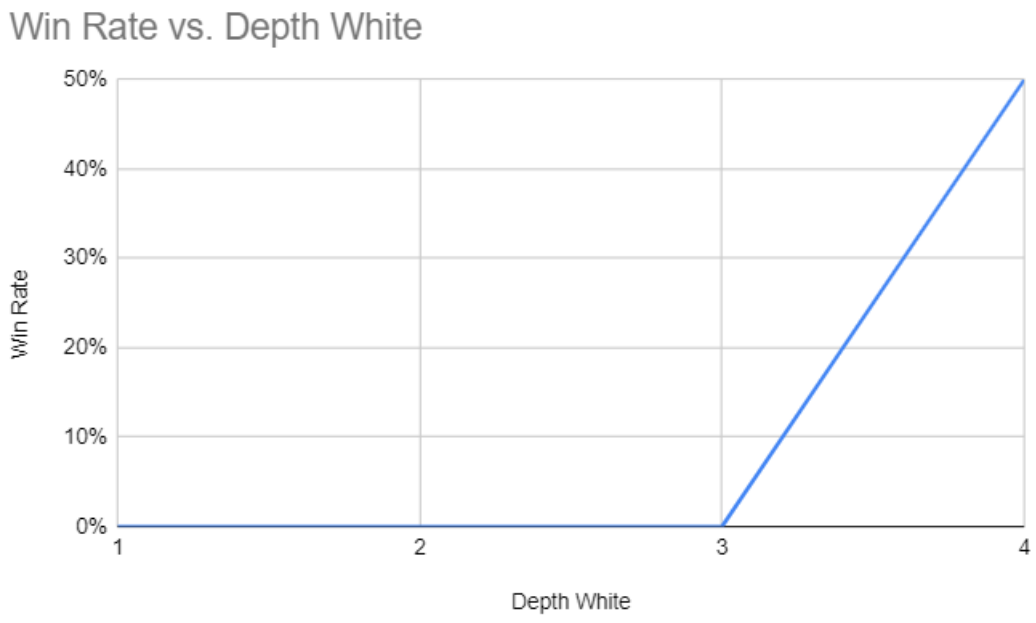
1. Whites start moving. Implement the dynamics of a game in which both, whites and blacks, follow the same Minimax algorithm to try to check-mate each other. Assume that both implement minimax with a depth of 4 moves.

a. Once implemented, run the same game a few times. How often do whites win?
White always wins with depth 4. We always reach draw be repetition with depths 2 and 3

b. Provide a justification for that.
At depth 4 white will always win as the tree is deep enough to find positions that reach checkmate. While depths 2 and 3 are only looking at the instantly best move which may be repeating checks and not finding a way to reach a checkmate.

2. Now run the same simulations, but varying the depth of the minimax algorithm from 3 to 7 moves both for whites and blacks. Run each possible combination of depths a few times.

a. Plot the percentage of white wins over the total for each depth value.
Now run the same simulations, but varying the depth of the minimax algorithm from 3 to 7 moves both for whites and blacks. Run each possible combination of depths a few times.



b. Is the result symmetric. Why is that?
Yes, the result is symmetric. For depths 1 – 3, white never wins, always ending in a draw by repetition of movements. For depth 4, white wins in the case that black has a depth of 3 or 4 but another draw by repetition for lower depths (1 and 2), winning in 50% of the cases.

Paula Bezares
20393015
Eshaan Mittal
20620983

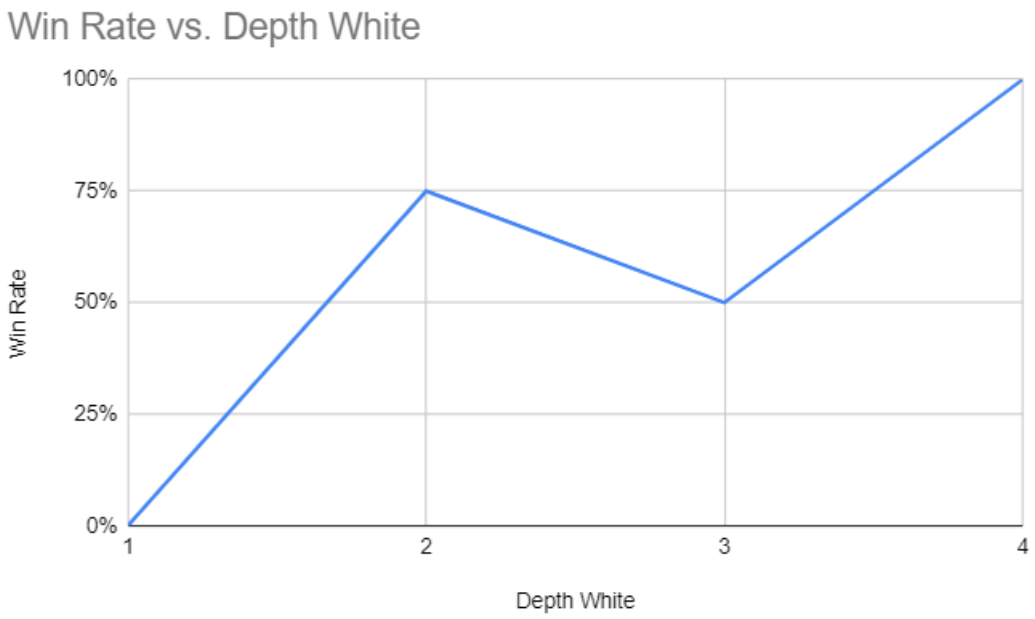
3. Implement the alfa-beta pruning for the blacks only, whites still play with minimax.

a. Using an equal depth of 4, run the simulation three times. Who is the best of three?
1: draw by repetition, 2: win, 3: win. White has won 2 out of three times.

b. Why is that?
This may happen as due to the functionality and radomising of the move order in the alpha beta code, a separate position that would give the same "political" value is pruned, but actually would have led to a win for white.

4. Both whites and blacks use the same alfa-beta pruning. Run three simulations each while varying the depth with which each team plays (1-5)

a. Plot the proportion of wins for whites and blacks.



b. Comment on the result.
It has now changed so that white wins in many more cases. As commented before, this may happen due to the shuffling of the move order and pruning of cases in which the "political" value was similar, but one position lead to checkmate while the other to a draw.

5. The situation generated by confronting a white king and a black king plus a rook each may be considered even

a. Is it really the case? Justify your answer.
It depends on the position of the kings and the rooks. In the position that we are given, it is not an equal position as the first move of either black or white will be to give a check, forcing the king to move and allowing for the rook to be taken. However, if the position is one such that the rook cannot be "skewered", we can consider the position to be equal.

Paula Bezares
20393015
Eshaan Mittal
20620983

b. In your opinion, what makes this situation of particular interest for the study of adversarial games?

In our opinion, the given position of the chess board is of interest as it provides for a clear first move, which would be checking the opposition king, then taking their rook. This allows for a strong “political” value at the base case for the position. As this is the case, the minimax tree is given a clear route to follow.

OBSERVATIONS

Heurisitic function is flawed. Rewards a check while not checking whether the rook will be eaten or not, problematic when check move comes at the last depth.
In alpha beta algorithm, as pruning can be more efficient when the child nodes are placed in a certain order, we have shuffled the possible moves before searching them in an attempt to try and optimize the algorithm. This change may lead to different ends to the game as two different positions may have the same political value, but one reaches checkmate while the other a draw.