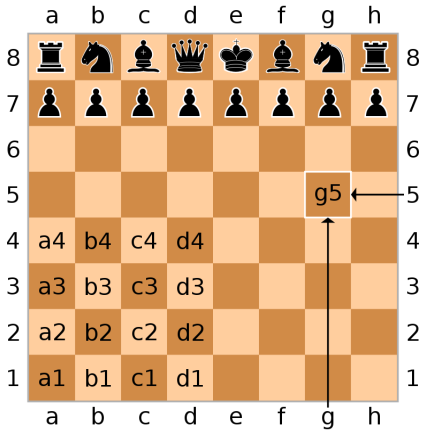
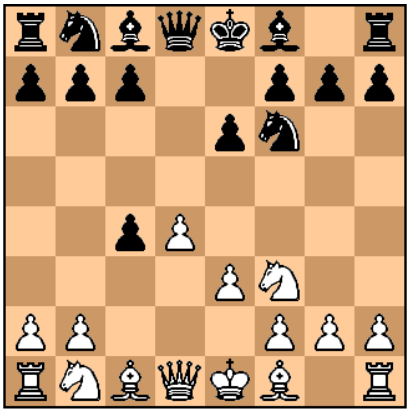
Our domain is about the chess game. We chose this domain because we both like playing chess and want to learn more about chess. So we came up with three research questions for this topic: (1) Which opening is the best to use in a chess game? (2) How does the time increment influence the game status? (3) Which of the combinations is most likely to win a game? White with a lower player rating? White with a higher player rating? Black with a lower player rating? Or black with a higher player rating?

After running the queries for the first question, we found out that 27 openings satisfy our definition of "the best opening" whose probability of winning is larger than 0.5, like what we did in <query label 2>. Notice that openings are used by players with white pieces here based on our datasets. The one with the highest probability of winning from <query label 1> is Queen's Gambit Accepted, whose Encyclopaedia of Chess Openings (ECO) code is D26. With this opening, the player with white pieces can win the game with a 62.5% chance. Using algebraic notation, the moves can be represented by: 1.d4 d5 2.c4 dxc4 3.Nf3 Nf6 4.e3 e6.





The right figure is what the chessboard looks like after opening D26. The left figure introduces how the chessboard is marked with algebraic notation. In addition, the ordinal number represents the number of turns. In each turn, white moves first with one piece and then black.

dxc4 here represents that the black pawn on square d5 in the last turn moves to square c4 and captures a white piece on this square (which is a white pawn). Capital N here represents knight.

Next, for each of the game statuses, "out of time", "mate" (a checkmate occurs), "draw", and "resign" (one of the players gives up to continue the game), we chose the top 10 time increments which are used in games at least 50 times, and most likely lead to this status respectively. We created tables in <query label 3> to <query label 6> to represent each status. Time increments 8+0, 9+0, 10+1, 180+0, 10+3, 7+2, and 12+0 have the highest probability (at least 10%) of leading to the status "out of time". Here the number before the plus sign is the time in minutes each player starts with, and the number after the plus sign is the extra time in seconds players can get whenever they make a move. If players want to have a checkmate, one of the time increments 20+20, 60+0, 7+9, 8+5, and 9+0 will be a better choice with at least 40% probability. For the status draw, players could select the time increment from 45+45, 30+10, 180+180, and 180+0, whose probabilities are at least 10%. And the time increments that have the highest probability (at least 65%) of leading to "resign" would be 20+15, 45+45, 30+30, 30+10, 180+180, and 8+8, and 5+21. In general, we can conclude that too little time given after each movement will increase the likelihood that the game ends due to a player's timeout. With too much time given at the beginning of a game or after movements, the probability that one of the players resigns the game or ends with a "draw" status will be higher than other increments.

For the last question, we figured out that the combination of white pieces and higher ratings gives the players a higher probability of winning, about 64.31%. From <query label 14>, it is clear that players with higher ratings have a higher probability of winning regardless of the colour of chess they are holding. And when the difference of ratings between two players exists, the one with white pieces will be more likely to win over the opponent. However, when the

players have similar playing strengths, winning the game with black is narrowly higher than winning the game with white.

In summary, we got the answers to all three of our questions. (1) Opening Queen's Gambit Accepted with D26 as its ECO code is best used in a chess game. (2) Choosing too little time after each movement increases the probability of the game ending due to a player's timeout. With too much time given at the beginning of a game or after movements, the probability that one of the players resigns the game or ends with a "draw" status will be higher than other increments. (3) Players with a white piece whose rating is higher is most likely to win a game.

Citation

1. Chess openings: Queen's gambit accepted (D26). (n.d.). Retrieved December 3, 2021, from https://www.chessgames.com/perl/chessopening?eco=d26.
2. Wikimedia Foundation. (2021, October 13). Algebraic notation (chess). Wikipedia. Retrieved December 3, 2021, from https://en.wikipedia.org/wiki/Algebraic_notation_(chess).