Assignment 1 Documentation

1. Names/Emails & Contributions
   * 1. Linh Cao - [linhcao@csu.fullerton.edu](mailto:lingcao@csu.fullerton.edu) (Programming/Heuristics)(20%)
     2. James Murphy - [jamesfmurphy@csu.fullerton.edu](mailto:jamesfmurphy@csu.fullerton.edu) (Testing/Documentation)(20%)
     3. Minh Nguyen - [hoangminh@csu.fullerton.edu](mailto:hoangminh@csu.fullerton.edu) (Programming)(20%)
     4. Tommy Phan - [tommyphan8@csu.fullerton.edu](mailto:tommyphan8@csu.fullerton.edu) (Leader/Programming)(20%)
     5. Michael Wypych - [mwypych@csu.fullerton.edu](mailto:mwypych@csu.fullerton.edu) (Documentation)(20%)
2. Running the Program
   * 1. Open a terminal and change the directory to the location of the chessAI\_final.py file
     2. Type the following command: python3 chessAI\_final.py on the command line.
     3. Type the word Play when prompted.
     4. Enter Y to run a test.
     5. The program will read from testCase.txt two different sets of coordinates. One set will be the initial state for the first game and the other will be the initial state for the second game.
     6. The command prompt window will display alternating moves until the limit is reached or the game is won.
     7. The results will be printed into a file named gameResult.txt.
3. Algorithm/Heuristics & Test Cases
   * 1. The minimax algorithm was used in addition to the Alpha-Beta pruning algorithm. The alpha beta pruning algorithm was used to decrease the number of nodes in the game tree.
     2. The heuristics used have advantages and disadvantages for both players. From the perspective of the player Y(BK) there are two aspects to the heuristic. The first aspect, which has a higher priority, is that the black king will go after the white rook. The second is if the black king moves toward the center it gains a higher heuristic value. By staying in the center the black king will be able to prolong the game and stay out of areas that will allow it to be cornered.

From the perspective of player X, the heuristic will increase as the opposing player’s king is forced into one of the four corners. In order to achieve this, the distance between the white king and black king is calculated and the distance between the white rook and black king is calculated. The two values are added together. The smaller the total value, the better the heuristic is.

* + 1. Test Case 1:

As of 10/07/15 at 11:00pm Player X(White) wins after 2 moves. However, both players are moving optimally in terms of the heuristics.

* + 1. Test Case 2:

As of 10/07/15 at 11:00pm a stalemate is reached after 35 moves.

1. References
   * 1. <https://en.wikipedia.org/wiki/Alpha–beta_pruning#Pseudocode>
2. Comments/Lessons Learned
   * 1. Managing heuristic values for even one player with one piece provides a fair challenge. As the number of pieces increases, the challenge of deciding what the heuristic will be also increases greatly. Refining the heuristic requires testing many potential states that the game can be in. It also requires thinking of the optimal move for each player.
     2. For this particular project, it is helpful to understand the rules of the game of chess. Even though good heuristics can be programmed, it helps to think what the best move would be from a human perspective first. This requires breaking down the reasoning behind what a good move is.

# 