

1. Initial startup
 - a. Game displays empty board
 - b. Game waits for user to start a new game
2. File menu options available at all times
 - a. User chooses to start a new game
 - i. User is asked to select either white or black as his/her color
 - ii. White is set to move first
 - iii. Halfmove counter set to 0
 - iv. Fullmove counter set to 1
 - v. All fields cleared out
 - vi. The New Game and Load Game elements are disabled
 - vii. The Save, Stop, Undo, and Help Me Move buttons are enabled
 - viii. Game begins; jump to section 6
 - b. User chooses to load a pre-existing game, "Load Game..." menu
 - i. User chooses to load a game from an existing FEN file
 1. File is chosen with `JFileChooser`
 2. File is checked for validity (proper extension, format, etc.)
 3. File is determined to be playable
 4. File is confirmed to contain 1 to 16 pieces for each side
 5. Board layout is confirmed, built
 6. En passant tile is recorded, if any
 7. Castling rights are given to both kings, if any exist
 8. Next player is determined
 9. Halfmove counter properly set
 10. Fullmove counter properly set
 11. User chooses to play as white or black
 12. The New Game and Load Game elements are disabled
 13. The Save, Stop, Undo, and Help Me Move buttons are enabled
 14. Game continues as explained in section 6
 - ii. User chooses to input a custom FEN string on the fly
 1. String is checked for validity, playability
 2. Checks performed identically to section 2 b i 1-13
 3. Jump to section 6
 - c. User chooses to quit
 - i. Program asks user if s/he really wants to quit
 - ii. If the answer is no
 1. Jump to section 6
 - iii. If the answer is yes
 1. A game is in progress
 - a. The other side automatically wins by resignation
 2. The game closes
3. File menu options only available during an active game
 - a. Undo button

- i. Checks to see if at least 2 or 3 halfmoves have been made already (2 if the human is white, 3 if the human is black)
 - 1. Jump to section 6
 - ii. Undoes the last two halfmoves made, resets pieces, castling rights, etc.
 - iii. Allows the user to move again in the previous configuration
 - iv. Jump to section 6
 - b. Save button
 - i. Asks user yes/no if s/he wants to save the current game
 - 1. Jump back to section 1 if user says “no”
 - ii. Saves the game as a FEN file with the current timestamp in a special “Serial” directory in the project folder
 - iii. Pop-up window notifies the user of the filename
 - iv. Board is emptied in preparation for a new game
 - v. The New Game and Load Game elements are enabled
 - vi. The Save, Stop, Undo, and Help Me Move buttons are disabled
 - vii. Jump to section 1
 - c. Stop button
 - i. Asks user if s/he wants to stop the game without saving
 - 1. If yes
 - a. Board is cleared, opponent wins by resignation
 - b. The New Game and Load Game elements are enabled
 - c. The Save, Stop, Undo, and Help Me Move buttons are disabled
 - d. Jump to section 1
 - 2. If no,
 - a. Game continues as per section 6
- 4. Help menu options available at all times
 - a. Instructions on how to use the Dark Blue chess engine
 - i. Gives the player detailed PDF instructions on how the program works
 - b. Link opening a local PDF of the official FIDE rules of chess in the user’s browser
 - i. Shows all basics of pieces, moves, and gameplay, as well as other rules that do not apply to this engine
- 5. Help menu options only available during an active game
 - a. “Help Me Move” button
 - i. Computes the best move using the computer’s own minimax algorithm, but from the human player’s perspective
 - ii. Disables both menus
 - iii. Shows a “Thinking...” window until the window with the move pops up
 - iv. Enables both menus
 - v. Can be clicked any number of times during a game without a penalty

6. Playing a game

- a. Once a game is initially started, an observer method checks for any game-ending conditions on the board just in case a FEN file with one side already in checkmate, stalemate, etc. cannot continue to be played
- b. The current state of the board is recorded.
 - i. If this board state has never been seen before, it is recorded as a key in the game history map with a value of 1
 - ii. If this configuration has been seen, its entry is found and its value is incremented by 1
- c. Current legal moves are calculated for both sides
- d. Castling rights for FEN are determined
 - i. Rights are compared with the king's current castling rights
 - ii. If there are any inconsistencies between the king's fields and the rights that were just determined, the newer rights win out and a new king is instantiated
- e. Promotions are examined on the previous player's last rank
 - i. If any promotions can be made
 1. The player is forced to choose a piece to promote his/her/its pawn to
 2. The new piece and its capabilities take effect immediately
- f. Current legal moves are calculated again in case any promotions were made
- g. If a game-ending condition is found
 - i. The current player is in checkmate
 1. The other player is black
 - a. White wins, pop-up displayed
 2. The other player is white
 - a. Black wins, pop-up displayed
 - ii. The current player is in stalemate
 1. The game ends in a draw
 - iii. The current player has made the fiftieth halfmove after no pawn movements or captures
 1. The game ends in a draw
 - iv. Both players have insufficient material
 1. Both players have bare kings
 - a. The game ends in a draw
 2. One player has his/her king and the other has his/her king and a bishop
 - a. The game ends in a draw
 3. One player has his/her king and the other has his/her king and a knight
 - a. The game ends in a draw
 4. Both players have their kings and one bishop and both bishops move on the same tile color

- a. The game ends in a draw
 - v. The same configuration of a board has been repeated three times
 - 1. The game ends in a draw
 - vi. The Undo, Save, Stop, and Help Me Move buttons are disabled
 - vii. The New Game, Load Game elements are enabled
 - viii. Jump to section 1 regardless of the outcome
- h. If the player playing next is the computer
 - i. Nothing happens if the game is over
 - ii. If the game is not over, the observer calls the computer's play method
 - iii. The computer computes its move in the background with minimax
 - iv. A "Thinking..." dialog is spawned and displayed
 - v. Both menus become disabled
 - vi. Once the move is computed, the moving piece, the victim, and other important information is recorded
 - vii. The dialog is disposed
 - viii. Both menus become enabled
 - ix. The move history window is updated
 - x. The internal board is changed to reflect the newly-made move
 - xi. The newly-moved piece and its row and column fields are copied
 - xii. If a pawn was moved 2 tiles on its first move, the tile behind it is recorded as the next en passant tile
 - xiii. The observer is called again to check for game-ending conditions.
 - xiv. Jump to section 6a
- i. If the player playing next is the human
 - i. Nothing happens on a mouse click if the game is over.
 - 1. Go back to section 1 but displaying the previously played game
 - ii. If the human is in check
 - 1. A pop-up window displays, saying "Check!" and all castling moves are removed
 - iii. The human is allowed all the time s/he needs
 - iv. The human clicks the Help Me Move button
 - 1. Help is calculated and displayed
 - 2. Jump to section 6 i iii
 - v. The human clicks the Undo button
 - 1. Correct number of halfmoves is determined to have been made
 - a. Previous two halfmoves are removed and their respective
 - b. Both boards are either decremented or removed from the hash
 - c. UI is updated
 - d. Jump to section 6 i iii
 - vi. The human has not yet selected a piece
 - 1. The human clicks on an occupied tile
 - a. The piece occupying the tile is friendly

- i. The piece has no legal moves
 - 1. A warning appears
 - 2. Jump to section 6 i vi
 - ii. The piece has at least one legal move
 - 1. The piece's current tile and all of its legal move tiles are highlighted in green
 - 2. Jump to 6 i vii
 - b. The piece occupying the tile is an enemy
 - i. A warning appears
 - ii. Jump to section 6 i vi
- 2. The human clicks on an empty tile
 - a. A warning appears
 - b. Jump to section 6 i vi
- vii. The human has selected a piece
 - 1. The human clicks on the piece itself
 - a. All green tiles change back to normal colors
 - b. Jump to section 6 i vi
 - 2. The player clicks on one of the green tiles that is not where the piece is currently resting
 - i. All green tiles change back to normal colors
 - 1. The move is calculated and made
 - 2. The UI is updated
 - 3. The observer is called
 - 4. Jump to section 6b
 - 3. The user clicks on any tile other than the ones mentioned above
 - a. A warning appears
 - b. Jump to section 6 i vii