ChessCraft v3.0 User Manual

Produced by ChessCrafters

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Glossary

Chess Pieces

- *Bishop* - A chess piece that moves diagonally on the board in both directions. Each side contains two bishops at the start of the game.
- *King* - The most important piece in the game. The King can move one step in any direction. The King has a special "castling" move (see *Chess Terms*). Each side has a single king at the start of the game.
- *Knight* - A chess piece that can jump to eight different squares (two steps forward and one step sideways). Each side contains two knights at the start of the game.
- *Pawn* - A chess piece that can only move forward but captures diagonally. The pawn can move two steps from its initial position, otherwise, it can only move one step forward at a time. Once a pawn reaches the end of the board, it is automatically promoted to another

piece (typically a queen). The pawn has a special "en passant" move (see *Chess Terms*). Each side contains eight pawns at the start of the game.

- *Queen* - A chess piece that can move horizontally, vertically, and diagonally across the board. Each side has a single queen at the start of the game.
- *Rook* - A chess piece that moves horizontally and vertically on the board. Each side contains two rooks at the start of the game.

Chess Terms

- *White Pieces* - The pieces of the player who has the first move.
- *Black Pieces* - The pieces of the player who has the second move.
- *Capture* - When a piece removes an opponent's piece on the board. The piece occupies the square of the captured piece (except in cases of *en passant).*
- *Castling* - A special move where a rook and the king of the same color are moved at the same time. This move consists of moving the king two squares towards the rook and moving the rook to where the king was. Castling can only happen if the king and rook involved have never been moved before, the squares in between the pieces are not occupied, the king is not in check, and the king does not cross over or end up in a square that would be in check.
- *Check* - A position where a player's king is under threat of capture on the opponent's next turn.
- *Checkmate* - A position where a player's king is in check and there are no legal moves to escape. Once checkmate occurs, that player loses the game.
- *En Passant* - A special pawn capture that occurs after a player moves its pawn two squares from its initial position. The opponent captures the just-moved pawn by moving to the square that was just passed over.
- *Promotion* - Once a pawn reaches the eighth rank, it can be converted to a queen, bishop, knight, or rook.
- *Rank* - A row of the chessboard, numbered 1-8.
- *File* - A column of the chessboard, lettered a-h.

1. Computer Chess

1.1 Usage scenario

1. Main Menu - When the program is first loaded, the user is prompted to choose one of three game modes: One player, Two players, or AI vs. AI. The player will select one by typing the corresponding number for the option they want (1, 2, and 3 respectively) and will be prompted with different game options. There is also a fourth option if the user wants to quit the game.

```
--------ChessCraft--------

Welcome to ChessCraft v.3.0

Game modes:
1. One Player
2. Two Players
3. AI vs. AI
4. Quit Game

Select a game mode (1-4): ▊
```

2. Options - The player will type the number of the choice they want for each option.

```
[Select to play as White (1) or Black (2): 1

Difficulty Levels:
 1.Easy
 2.Medium
 3.Hard

[ Select a Difficulty Level: 2

Select to Play (1) or Change Options (2): 1▊
```

    a. *Color* - The user selects to play as White or Black.
    b. *Difficulty* - The user selects the AI difficulty, from choices Easy, Medium, and
       Hard.
    c. *Play* - Starts the game by displaying the board if the user chooses to play. If the
       user chooses the second option (Change Options), the initial menu options will be
       displayed again.

3. In-Game

```
    +----+----+----+----+----+----+----+----+
  8 | bR | bN | bB | bQ | bK | bB | bN | bR |
    +----+----+----+----+----+----+----+----+
  7 | bP | bP | bP | bP | bP | bP | bP | bP |
    +----+----+----+----+----+----+----+----+
  6 |    |    |    |    |    |    |    |    |
    +----+----+----+----+----+----+----+----+
  5 |    |    |    |    |    |    |    |    |
    +----+----+----+----+----+----+----+----+
  4 |    |    |    |    |    |    |    |    |
    +----+----+----+----+----+----+----+----+
  3 |    |    |    |    |    |    |    |    |
    +----+----+----+----+----+----+----+----+
  2 | wP | wP | wP | wP | wP | wP | wP | wP |
    +----+----+----+----+----+----+----+----+
  1 | wR | wN | wB | wQ | wK | wB | wN | wR |
    +----+----+----+----+----+----+----+----+
      a    b    c    d    e    f    g    h
It is Player 1's Turn.
Select Piece Location or Option(To see option commands, Type "options"): options
Options (Type the command you want below):
- Hint
- Cancel
- Quit
Select Piece Location or Option(To see option commands, Type "options"): █
```

a. Game Board - When it is their turn, the player will type the location on the board of the piece they want to move using standard Algebraic notation (e.g. "*a1*"). The board will highlight all the possible places that the piece could legally move, including potential captures of the opposing pieces with an * sign. The player is then prompted again to type the location they want to move that piece to using the same format. Illegal moves will result in an error message (see *Error Messages*).

b. Options - Outside of the chess game itself, the player has a few alternative options to type when it is their turn.
   i. *Hint* - The program will give the user a suggestion for what move to make
   ii. *Cancel* - After selecting a piece, a user can cancel their selection and choose another piece.
   iii. *Quit* - Quits the current game and returns to the Main Menu.

1.2 Goals

1. The program's objective is to allow users to play a game of chess against a computer or another human player. A third option of AI vs AI is also offered where the user can observe the computer play against itself. The game will be virtually displayed by text in the terminal and will follow the basic rules of chess. The software's design includes the features described below, ensuring the user a seamless and enjoyable chess experience.

1.3 Features

The user can:
- Choose to play against a computer and choose different levels of difficulty.
- Choose to play against another human player.

- Choose to observe an AI vs AI game
- Choose to play as the white or black pieces.
- Ask for hints.
- Cancel a selected piece

Other features include:

- Game Log that records all moves with timestamps

2. Installation

2.1 System Requirements

To run ChessCraft v3.0, you must own a computer/laptop with the minimum system requirements:

- Storage space of at least 10MB
- At least 1GB of RAM
- Linux Operating System
- GCC Compiler
- GNU Make
- C11
- Evince Document Viewer (or any PDF viewer)
- A computer that can download files from a browser

Libraries:

- Math Library

2.2 Setup and Configuration

Steps for Installation:

1. Navigate to the desired location to store chess program
   cd {desired location}
2. Copy source code file to the new directory
   cp ~/{old location}/ChessV1.0.tar.gz .

3. Open a Linux terminal in the directory where ChessAlpha.tar.gz is located and enter the following command to unpackage the program files:
   tar xvzf ChessV1.0.tar.gz
4. Open the user manual with Evince (or document view of choice):
   evince chess/doc/Chess_UserManual.pdf
5. Run the executable to install the program
   bin/Chess

2.3 Uninstalling

1. Open a Linux terminal in the directory where ChessCraft_v.1.tar.gz is located and enter the following command to remove the program file:
   rm bin/Chess

3. Chess Program Functions and Features

3.1 Main Menu

```
--------ChessCraft--------

Welcome to ChessCraft v.3.0

Game modes:
1. One Player
2. Two Players
3. AI vs. AI
4. Quit Game

Select a game mode (1-4): █
```

- The user can choose between 3 game types by entering a number (1-3). The user can also enter (4) if they want to quit the program. Once selected, they will select their preference for three different options, similarly using the numbers corresponding with their choice.

```
[Select to play as White (1) or Black (2): 1

Difficulty Levels:
 1.Easy
 2.Medium
 3.Hard

[ Select a Difficulty Level: 2

Select to Play (1) or Change Options (2): 1█
```

3.2 Gameboard

- The user will see and interact with the gameboard, which contains 64 squares arranged in 8 ranks (1-8) and 8 files (a-h).
- Each square will have a unique combination of a rank number and file letter (e.g. the bottom left corner is 'a1').
- The board will also display the pieces and their corresponding position updated as they move in the game

```
        +----+----+----+----+----+----+----+----+
      8 | bR | bN | bB | bQ | bK | bB | bN | bcR|
        +----+----+----+----+----+----+----+----+
      7 | bP | bP | bP | bP | bP | bP | bP | bP |
        +----+----+----+----+----+----+----+----+
      6 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      5 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      4 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      3 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      2 | wP | wP | wP | wP | wP | wP | wP | wP |
        +----+----+----+----+----+----+----+----+
      1 | wR | wN | wB | wQ | wK | wB | wN | wR |
        +----+----+----+----+----+----+----+----+
          a    b    c    d    e    f    g    h
```

3.3 Move

- When prompted with "Select Piece Location", the player can type the location of the piece that they want to move (e.g. "*e2*"). The board will then highlight all possible moves for that piece. After selecting a piece, the game will prompt for their desired move: "Select Piece Movement". The player can then type the location of their desired move (e.g. "*e4*").
- After the user inputs a move, the gameboard will be updated and displayed.

```
      +----+----+----+----+----+----+----+----+
    8 | bR | bN | bB | bQ | bK | bB | bN | bR |
      +----+----+----+----+----+----+----+----+
    7 | bP | bP | bP | bP | bP | bP | bP | bP |
      +----+----+----+----+----+----+----+----+
    6 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    5 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    4 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    3 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    2 | wP | wP | wP | wP | wP | wP | wP | wP |
      +----+----+----+----+----+----+----+----+
    1 | wR | wN | wB | wQ | wK | wB | wN | wR |
      +----+----+----+----+----+----+----+----+
        a    b    c    d    e    f    g    h
It is Player 1's Turn.
Select Piece Location or Option(To see option commands, Type "options"): e2
```
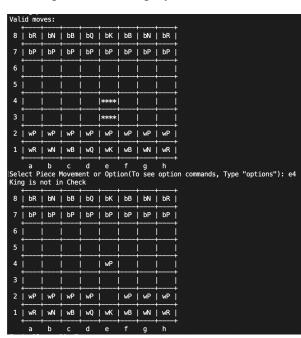
```
Valid moves:
      +----+----+----+----+----+----+----+----+
    8 | bR | bN | bB | bQ | bK | bB | bN | bR |
      +----+----+----+----+----+----+----+----+
    7 | bP | bP | bP | bP | bP | bP | bP | bP |
      +----+----+----+----+----+----+----+----+
    6 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    5 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    4 |    |    |    |****|    |    |    |    |
      +----+----+----+----+----+----+----+----+
    3 |    |    |    |****|    |    |    |    |
      +----+----+----+----+----+----+----+----+
    2 | wP | wP | wP | wP | wP | wP | wP | wP |
      +----+----+----+----+----+----+----+----+
    1 | wR | wN | wB | wQ | wK | wB | wN | wR |
      +----+----+----+----+----+----+----+----+
        a    b    c    d    e    f    g    h
Select Piece Movement or Option(To see option commands, Type "options"): e4
King is not in Check

    8 | bR | bN | bB | bQ | bK | bB | bN | bR |
      +----+----+----+----+----+----+----+----+
    7 | bP | bP | bP | bP | bP | bP | bP | bP |
      +----+----+----+----+----+----+----+----+
    6 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    5 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    4 |    |    |    |    | wP |    |    |    |
      +----+----+----+----+----+----+----+----+
    3 |    |    |    |    |    |    |    |    |
      +----+----+----+----+----+----+----+----+
    2 | wP | wP | wP | wP |    | wP | wP | wP |
      +----+----+----+----+----+----+----+----+
    1 | wR | wN | wB | wQ | wK | wB | wN | wR |
      +----+----+----+----+----+----+----+----+
        a    b    c    d    e    f    g    h
```

3.4 Cancel

- After selecting a piece, the user has the ability to cancel their piece selection.
- Once a user types in *"cancel"*, the user will be prompted to select another piece

```
        +----+----+----+----+----+----+----+----+
      8 | bR | bN | bB | bQ | bK | bB | bN | bR |
        +----+----+----+----+----+----+----+----+
      7 | bP | bP | bP | bP | bP | bP |    | bP |
        +----+----+----+----+----+----+----+----+
      6 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      5 |    |    |    |    |    |    | bP |    |
        +----+----+----+----+----+----+----+----+
      4 |    |****|    |    |    | wP |    |    |
        +----+----+----+----+----+----+----+----+
      3 |    |****|    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      2 | wP | wP | wP | wP | wP |    | wP | wP |
        +----+----+----+----+----+----+----+----+
      1 | wR | wN | wB | wQ | wK | wB | wN | wR |
        +----+----+----+----+----+----+----+----+
          a    b    c    d    e    f    g    h
Select Piece Movement or Option(To see option commands, Type "options"): cancel
You have cancelled your move.
        +----+----+----+----+----+----+----+----+
      8 | bR | bN | bB | bQ | bK | bB | bN | bR |
        +----+----+----+----+----+----+----+----+
      7 | bP | bP | bP | bP | bP | bP |    | bP |
        +----+----+----+----+----+----+----+----+
      6 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      5 |    |    |    |    |    |    | bP |    |
        +----+----+----+----+----+----+----+----+
      4 |    |    |    |    |    | wP |    |    |
        +----+----+----+----+----+----+----+----+
      3 |    |    |    |    |    |    |    |    |
        +----+----+----+----+----+----+----+----+
      2 | wP | wP | wP | wP | wP |    | wP | wP |
        +----+----+----+----+----+----+----+----+
      1 | wR | wN | wB | wQ | wK | wB | wN | wR |
        +----+----+----+----+----+----+----+----+
          a    b    c    d    e    f    g    h
Select Piece Location or Option(To see option commands, Type "options"): 
```

3.6 Hint

- During the user's turn, the user may receive a hint by typing "*hint*".
- The program will suggest a move to the user.

```
Hint: You should move the piece on F2 to F4
Select Piece Location or Option(To see option commands, Type "options"): 
```

3.7 Quit

- At any point in the game, the user may type "*quit*" to end the game, notifying the user that they have exited the game.

```
Select Piece Location or Option(To see option commands, Type "options"): quit
You have exited the game.
```

Back Matter

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Error messages

1. Invalid Menu Selection
   a. "Invalid option!!"
      i. When the user does not choose a correct game mode option (1-4)
      ii. When the user does not choose a correct color option (1-2)
      iii. When the user does not choose a correct difficulty option (1-3)
      iv. When when the user does not choose a correct play option (1-2)
2. Invalid Move Errors
   a. "Invalid input! …"
      i. Occurs when a player types an invalid input when prompted to select a piece
         1. No location inputted
         2. Input is not an alphabet letter followed by a digit
         3. Not physically on the board
         4. Inputted Coordinate is an empty location
         5. Contains a piece of the opponent's color
         6. Selected piece has no valid moves
3. Invalid Game Logic
   a. "Move … Error"
      i. Occurs when there's an error in the logic behind a specific piece's move
      ii. Pawn || Rook || Knight || Bishop || Queen || King
   b. "Invalid move, puts the king in check":
      i. Occurs when the player tries to make a move during one of these scenarios:
         1. King is in check
         2. The intermediate or final move puts the king in check
   c. "Invalid move, does not remove check":
      i. When the player tries to make a move that does not get their king out of check
   d. "En passant error!"
      i. Occurs when there is an error with taking an opponent's piece during En Passant
4. "Invalid Input! Input is not a valid command."
   a. Occurs when the player types a command that is not recognized by the program. Valid commands are as follows:
      i. *Quit*
      ii. *Cancel*
      iii. *Hint*

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