Computer Programming Project: Chess

Spring 2024

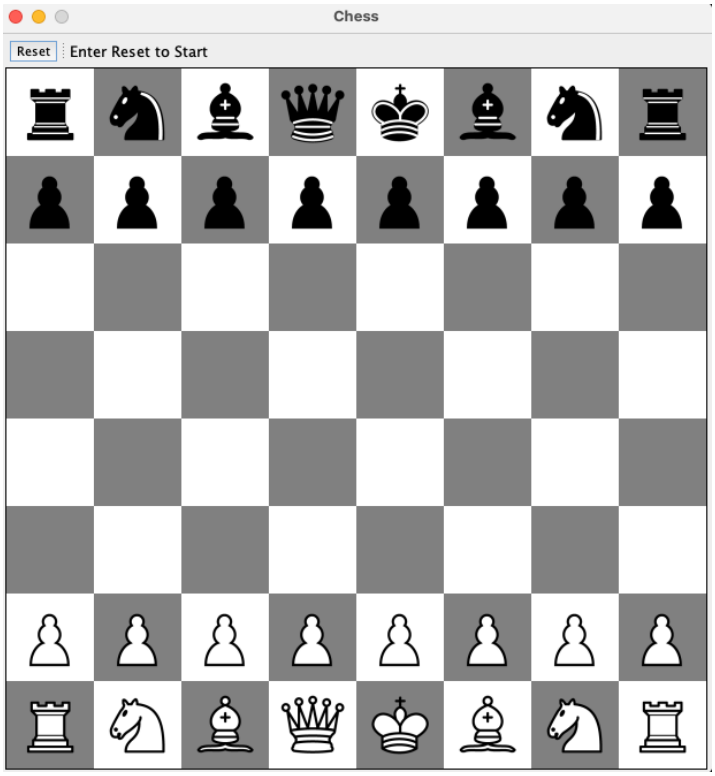
Overview:

Welcome to the world of chess! In this project, you'll create your own chess game using Java GUI.

Chess is a game of strategy where each piece moves in specific ways. Your task is to build a digital chessboard where players can move pieces according to the rules of the game. You'll need to implement features like turns, checking for when a king is in danger, and detecting when a player wins by checkmate.

This project is not just about coding; it's also about understanding the game of chess. As you work on your implementation, you'll learn about the strategic thinking involved in each move.

Get ready to dive into the world of chess and code your way to victory!



Initial Arrangement of Chess Pieces

Submission Guidelines:

- The evaluation of your work will be done by means of **IntelliJ IDE** using **JDK 22.0.1.** **Make sure your environment aligns with it to avoid any issue stems from inconsistency.**
- Only game rules explicitly outlined in this document are to be followed for your implementation (other game rules are **NOT** required).
- **Deadline:** June 23rd (**2024.6.23 23:59**), with a delayed submission allowed until June 25th (with a 20% deduction per day).
- **Submission Format:** your **ChessBoard.java** file (do **NOT** rename or zip the file).
- **Identification**: Include your **name** and **student number** as a comment at the top of the file.

- **Skeleton Code:**
    - **Do not modify the given skeleton code.**
    - The provided skeleton code includes GUI components implemented using Java Swing.
    - Students are required to implement the logic for piece movements and actions below Line 206 in the provided code.
    - Helper functions should be created for the movement of each piece and the corresponding actions.

Game Rules:

- **General Rules:**

    - **Players:** Two players, one controlling the black pieces and the other controlling the white pieces, take turns.
    - **Starting Positions**: Black starts from the top, and White starts from the bottom. White moves first.
    - **Move and Attack:** Each player can move one piece per turn or use that piece to attack an opponent's piece.

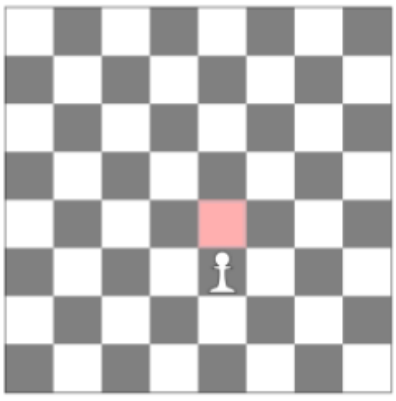
- **Pieces and Movements:**

6 pieces that can move or attack depending on their roles:

**Movement: Moving to an empty square without any pieces.*
**Attack: Moving to a square occupied by the opponent's piece to capture it.*

- **Pawn**
    - Moves forward one square, attacks diagonally.
    - Can move two squares forward on its first move.

(1)



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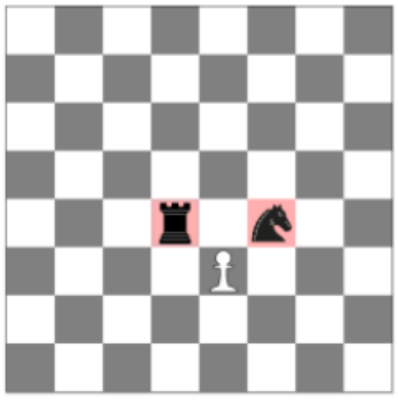

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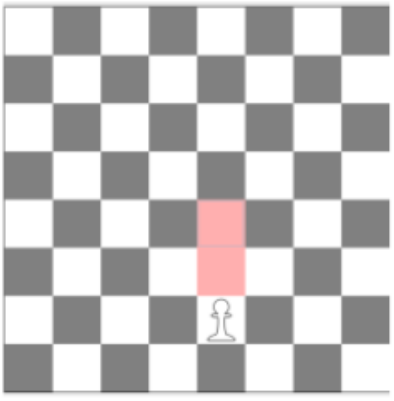
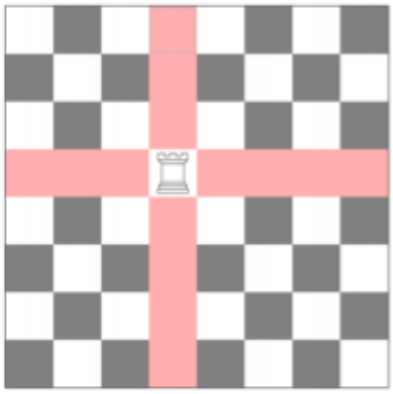
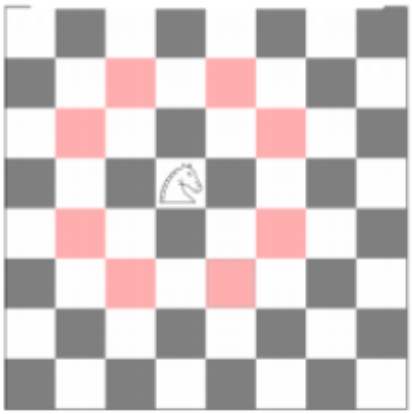


- **Rook**
  - Moves horizontally or vertically any number of squares.



- **Knight**
  - Moves in an L-shape (two squares in one direction and then one square perpendicular).
  - Can jump over other pieces.

Knight (1)

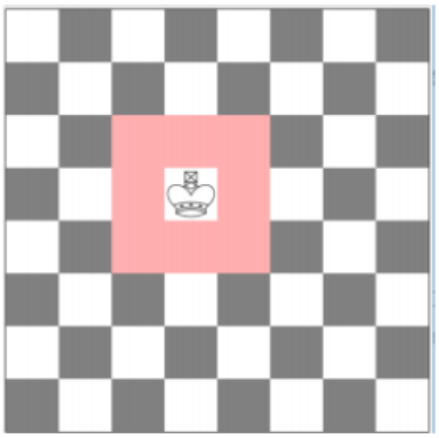


Knight (2)

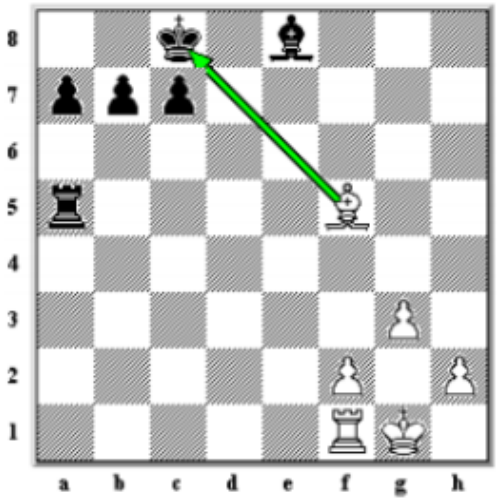
- **Bishop**
  - Moves diagonally any number of squares.

- **Queen**
  - Moves horizontally, vertically, or diagonally any number of squares.

- **King**
  - Moves one square in any direction.



- **Special Rules:**
  - **Check:** When a piece threatens to capture the opposing king.



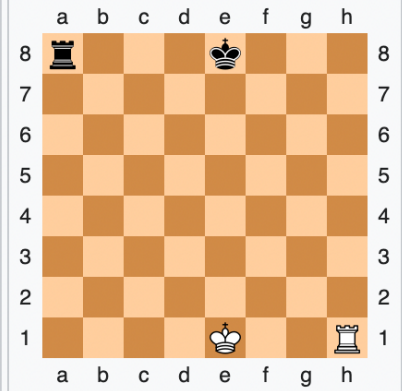
When a player's king is in check, they have several options to escape:

- Move the king to a safe square where it's not threatened.
- Capture the attacking piece.
- Block the path of the attacking piece so it can no longer threaten the king.

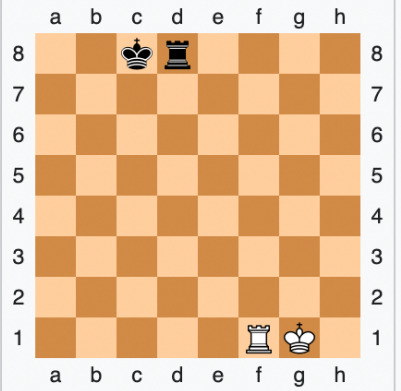
- **Checkmate**: When the king is in a position where it will inevitably be captured on the next turn, and no legal move can prevent it, this is called Checkmate.

- **Castling:** Castling involves moving the king two squares towards a rook and then placing the rook on the square immediately next to the king on the opposite side. Castling is allowed only if the following conditions are met:

  - Neither the king nor the rook involved has moved previously.
  - There are no pieces between the king and the rook.
  - The king is not currently in check, and the king does not land on a square that is attackable by an enemy piece right next turn (the rook, however, can land on an attacked square).
  - The castling move must be either kingside or queenside as illustrated in the diagram.

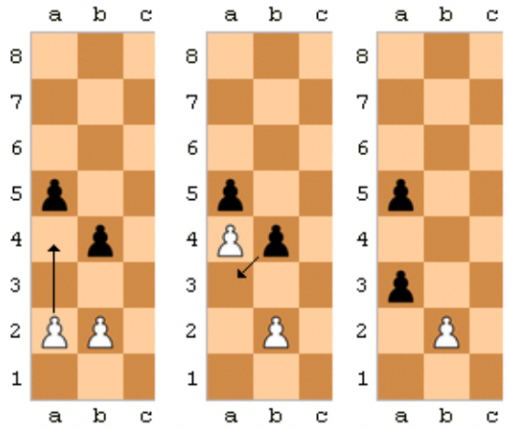


Position of pieces before castling



Positions of the king and rook after kingside (White) and queenside (Black) castling

- **En passant:** When a pawn moves two squares forward on its first move and lands next to an enemy pawn on the same rank, the enemy pawn can capture it en passant, as if the pawn had only moved one square. This special capture is only legal on the turn immediately following the pawn's advance. For example, if a white pawn moves from a2 to a4, the black pawn on b4 can capture it en passant by moving from b4 to a3, removing the white pawn on a4 from the board. The diagrams illustrate this situation:

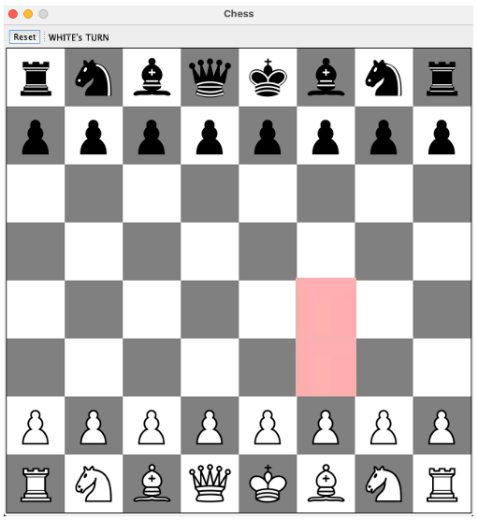


- **Promotion:** When a player moves a pawn to the eighth rank (8th row), it is promoted (converted) to a queen, rook, bishop, or knight of the same color, according to the player's choice (usually a queen is chosen). This choice is not restricted to pieces that have been previously captured. Therefore, a player could potentially have up to nine queens or ten rooks, bishops, or knights if all of their pawns are promoted.

Implementation:

- **User Interface:**
  - The game is implemented with a GUI where players move pieces with the mouse.
  - The board displays the **current state**, including **which player's turn it is** and if there is a check or checkmate situation.

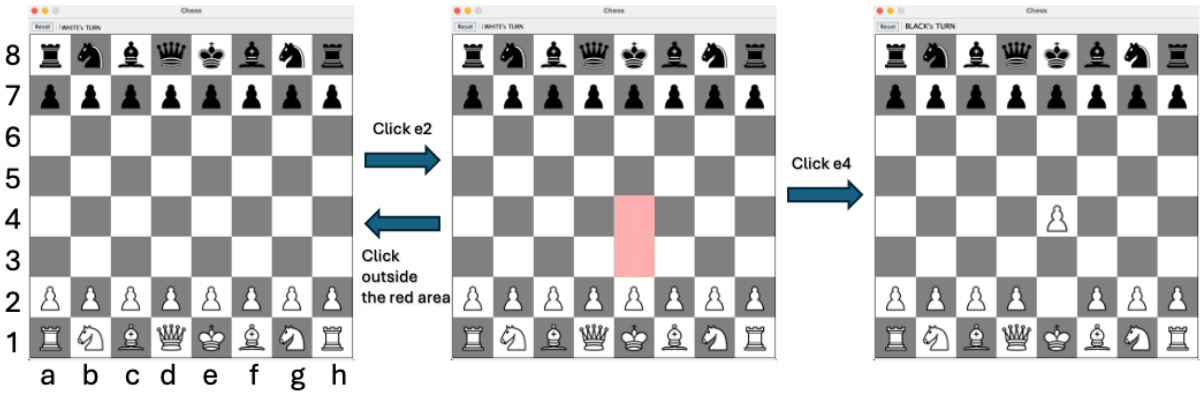
    **The first turn should always be white for convenience.*



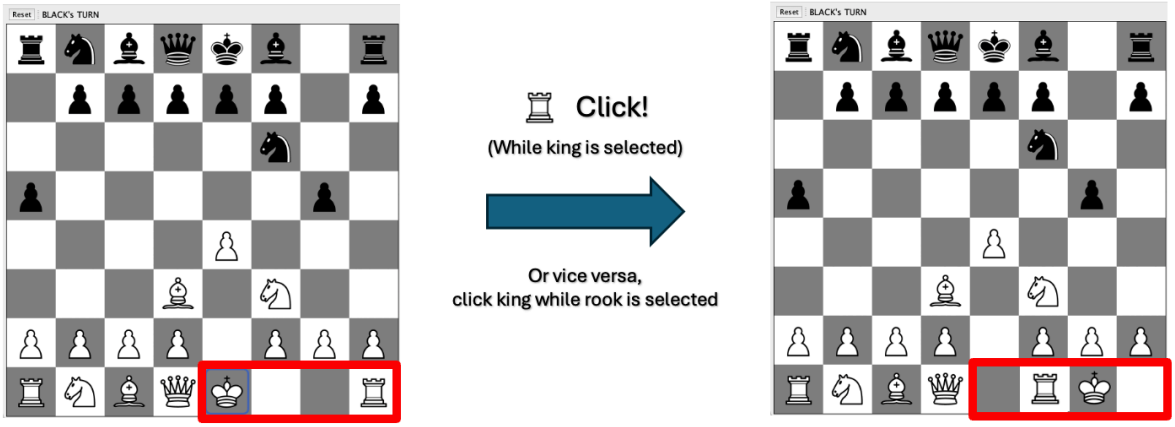
- **Functionalities:**
  - **Movement and Actions**:
    - During a player's turn, when they click on one of their pieces:

      - The game **highlights** the valid movement areas for that piece.
      - If the player clicks on a highlighted area, the piece moves there, the turn ends, and the order of play changes.
      - If the player clicks on an area where the piece cannot move, the highlight is **removed**.

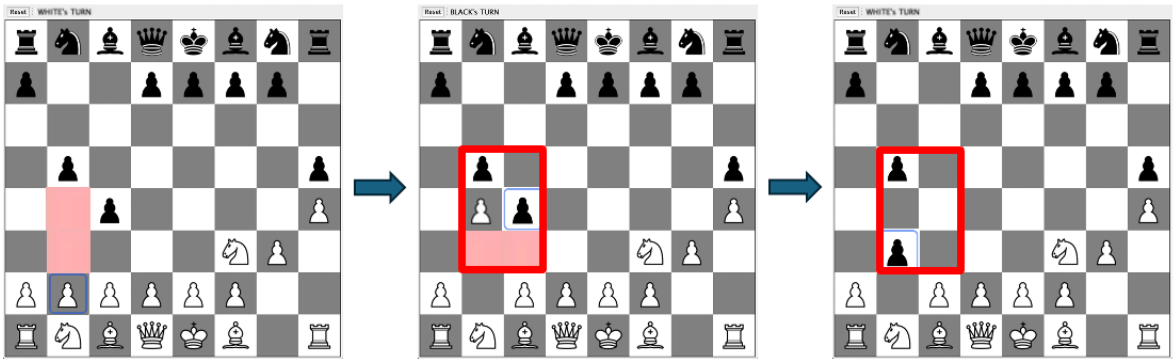
    - Clicking on any other area of the board has **no effect**.
      - If the game concludes (either by checkmate or the capture of the king), clicking on any area of the board **will not trigger** any response



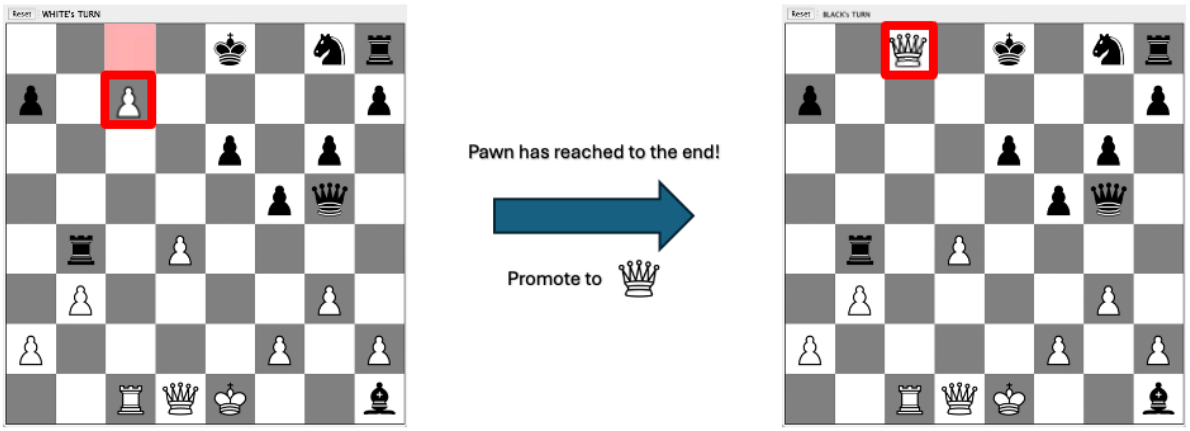
  - **Castling:**
    - Enable castling when the condition is met.
    - Refer the castling section of "game rules" given above for your implementation. You should regard every castling condition mentioned in "game rules". Below is the instance demonstrating king side castling (White team)



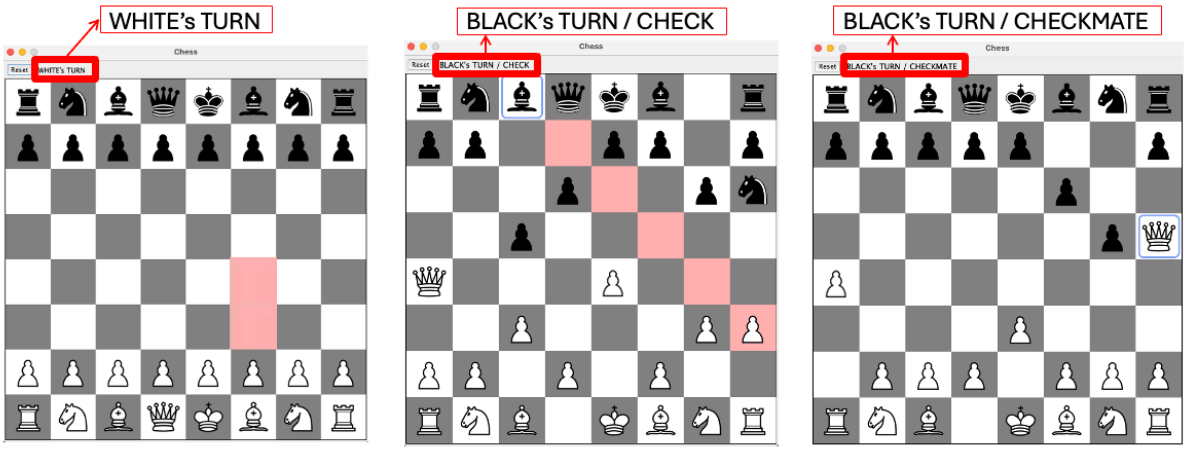
- **En passant:**
  - Enable en passant when the conditions are met.
  - Refer “game rules” for your en passant implementation.
  - Below is the instance demonstrating en passant rule performed:



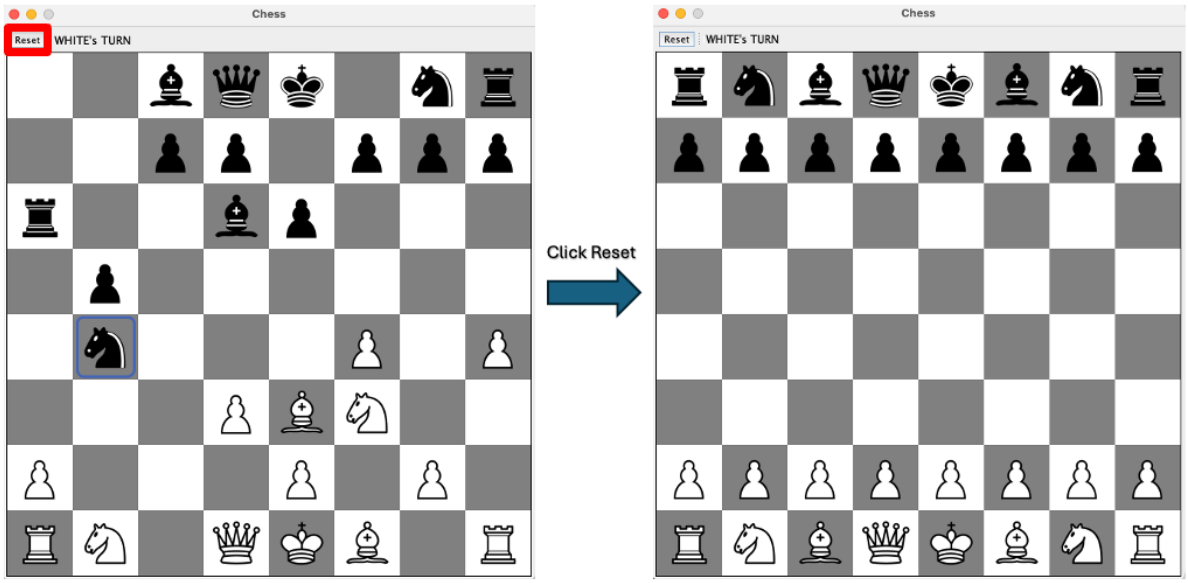
- **Promotion:**
  - Enable promotion when the condition is met.
  - Originally, a pawn can be promoted to every other kind of piece. Yet, as mostly chosen, and for convenience, let the end-reached pawn to be promoted to the queen automatically.
  - Below is the demonstration of the instance a pawn is promoted to the queen (White team)



- **Status Display:**
  - The status bar above should show clear strings indicating the current turn and the game's check status (whether it's in **check** or **checkmate**).
  - While there's no limit to the displayed strings, it's essential that the turn and check status are easily recognizable amidst any other information.



- **Reset Button:** Resets the board to its initial state. (This is already implemented in the skeleton code, except for status display and other initialization required specific to the implementation)



Grade Policy:

- **Total score: 150**
- Rightly performing piece of each kind: **60 points** (10 points per each)
  - Excluding special rules (castling, en passant, and promotion not regarded)
- Rightly displaying the turn / check / checkmate status: **30 points** (10 points per each)
- Rightly performing castling, en passant, and promotion: **50 points** (20 points per each for castling and en passant, 10 points for promotion)
- Rightly disabling any further action invocations when the game is ended: **10 points**