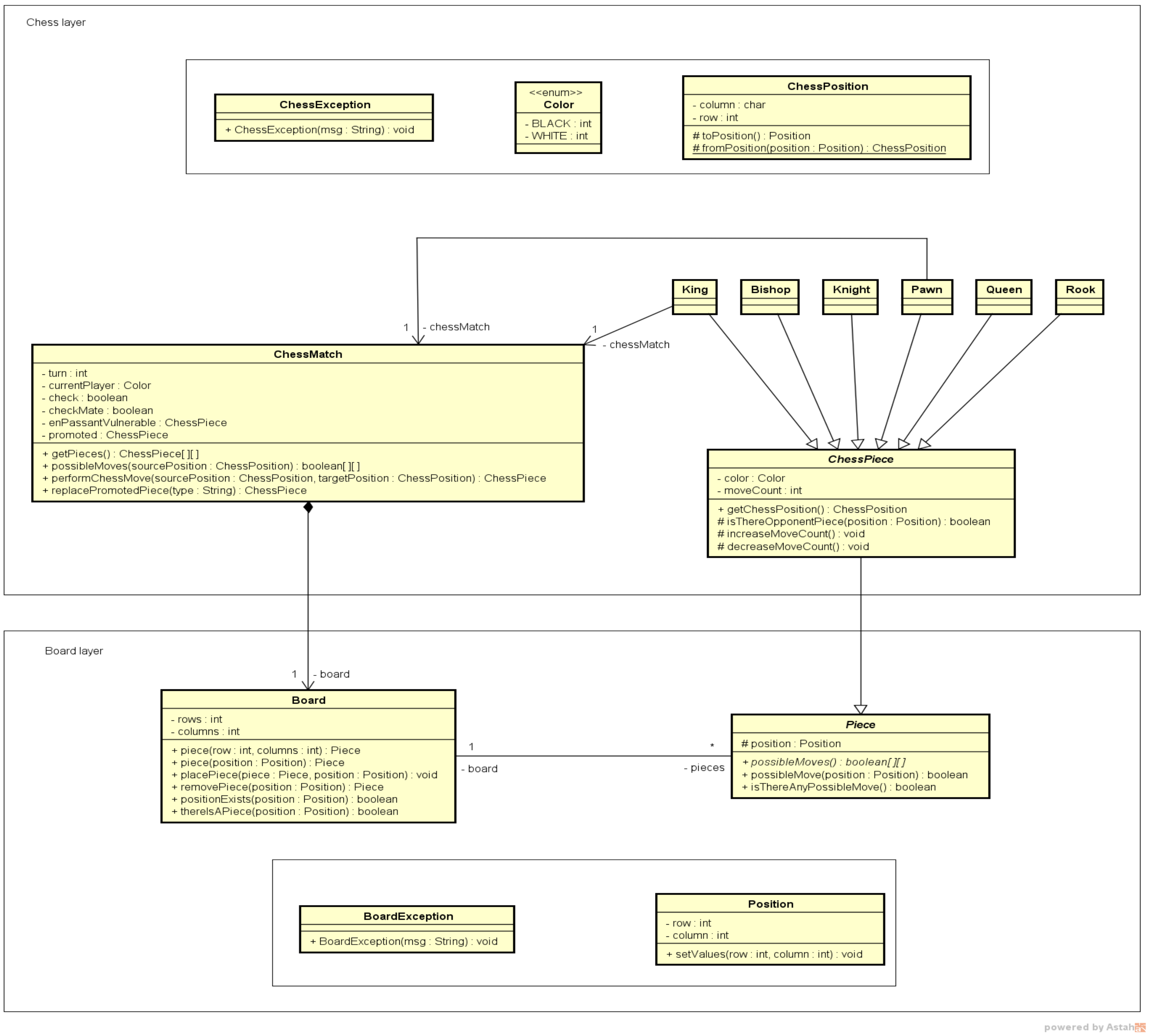
Curso: Programação Orientada a Objetos com Java
http://educandoweb.com.br
Prof. Dr. Nelio Alves

Capítulo: Projeto Sistema de Jogo de Xadrez

Objetivo geral:

- Aplicar os conhecimentos aprendidos até o momento no curso para a construção de um projeto

System design


Chess layer
ChessException
+ ChessException(msg : String) : void
<<enum>> Color
- BLACK : int
- WHITE : int
ChessPosition
- column : char
- row : int
# toPosition() : Position
# fromPosition(position : Position) : ChessPosition
King
Bishop
Knight
Pawn
Queen
Rook
1
- chessMatch
1
- chessMatch
ChessMatch
- turn : int
- currentPlayer : Color
- check : boolean
- checkMate : boolean
- enPassantVulnerable : ChessPiece
- promoted : ChessPiece
+ getPieces() : ChessPiece[ ][ ]
+ possibleMoves(sourcePosition : ChessPosition) : boolean[ ][ ]
+ performChessMove(sourcePosition : ChessPosition, targetPosition : ChessPosition) : ChessPiece
+ replacePromotedPiece(type : String) : ChessPiece
ChessPiece
- color : Color
- moveCount : int
+ getChessPosition() : ChessPosition
# isThereOpponentPiece(position : Position) : boolean
# increaseMoveCount() : void
# decreaseMoveCount() : void
Board layer
1
- board
Board
- rows : int
- columns : int
+ piece(row : int, columns : int) : Piece
+ piece(position : Position) : Piece
+ placePiece(piece : Piece, position : Position) : void
+ removePiece(position : Position) : Piece
+ positionExists(position : Position) : boolean
+ thereIsAPiece(position : Position) : boolean
1
- board
*
- pieces
Piece
# position : Position
+ possibleMoves() : boolean[ ][ ]
+ possibleMove(position : Position) : boolean
+ isThereAnyPossibleMove() : boolean
BoardException
+ BoardException(msg : String) : void
Position
- row : int
- column : int
+ setValues(row : int, column : int) : void
powered by Astah

Creating project and git repository

Checklist:

- Github: create a new project
  - **NOTE:** choose **`.gitignore`** type as Java
- Open a terminal in project folder, and perform the following commands:

```
git init
git remote add origin https://github.com/acenelio/chess-system-java.git
git pull origin master
git add .
git commit -m "Project created"
git push -u origin master
```

First class: Position

Checklist:

- Class Position [public]
- **OOP Topics:**
  - Encapsulation
  - Constructors
  - ToString (Object / overriding)

Starting to implement Board and Piece

Checklist:

- Classes Piece, Board [public]
- **OOP Topics:**
  - Associations
  - Encapsulation / Access Modifiers
- **Data Structures Topics:**
  - Matrix

Chess layer and printing the board

```
8 - - - - - - - -
7 - - - - - - - -
6 - - - - - - - -
5 - - - - - - - -
4 - - - - - - - -
3 - - - - - - - -
2 - - - - - - - -
1 - - - - - - - -
  a b c d e f g h
```

Checklist:

- Methods: Board.Piece(row, column) and Board.Piece(position)
- Enum Chess.Color
- Class Chess.ChessPiece [public]
- Class Chess.ChessMatch [public]
- Class ChessConsole.UI
- **OOP Topics:**
  - Enumerations
  - Encapsulation / Access Modifiers
  - Inheritance
  - Downcasting
  - Static members
  - Layers pattern
- **Data Structures Topics:**
  - Matrix

Placing pieces on the board

Checklist:

- Method: Board.PlacePiece(piece, position)
- Classes: Rook, King [public]
- Method: ChessMatch.InitialSetup
- **OOP Topics:**
  - Inheritance
  - Overriding
  - Polymorphism (ToString)

BoardException and defensive programming

Checklist:

- Class BoardException [public]
- Methods: Board.PositionExists, Board.ThereIsAPiece
- Implement defensive programming in Board methods
- **OOP Topics:**
    - Exceptions
    - Constructors (a string must be informed to the exception)

ChessException and ChessPosition

Checklist:

- Class ChessException [public]
- Class ChessPosition [public]
- Refactor ChessMatch.InitialSetup
- **OOP Topics:**
    - Exceptions
    - Encapsulation
    - Constructors (a string must be informed to the exception)
    - Overriding
    - Static members
    - Layers pattern

Little improvement in board printing

Color in terminal:

- Windows: Git Bash
- Mac: Google "osx terminal color"

Checklist:

- Place more pieces on the board
- Distinguish piece colors in UI.PrintPiece method

Moving pieces

Checklist:

- Method Board.RemovePiece
- Method UI.ReadChessPosition
- Method ChessMatch.PerformChessMove
    - Method ChessMatch.MakeMove
    - Method ChessMatch.ValidadeSourcePosition
- Write basic logic on Program.cs
- **OOP Topics:**
    - Exceptions
    - Encapsulation

Handling exceptions and clearing screen

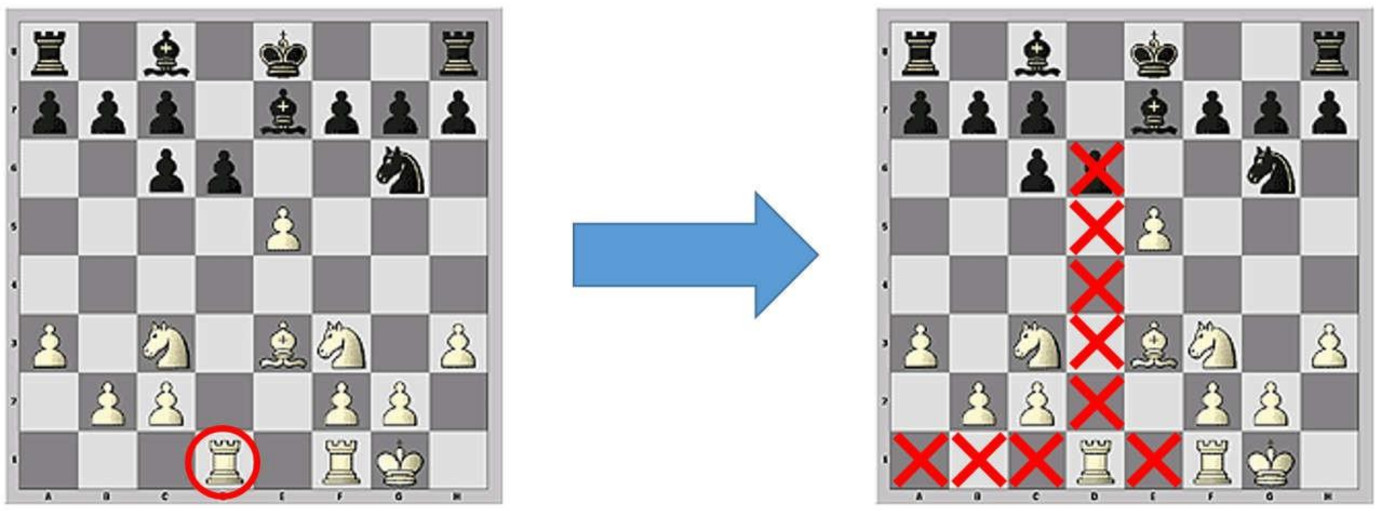
Clear screen using Java:

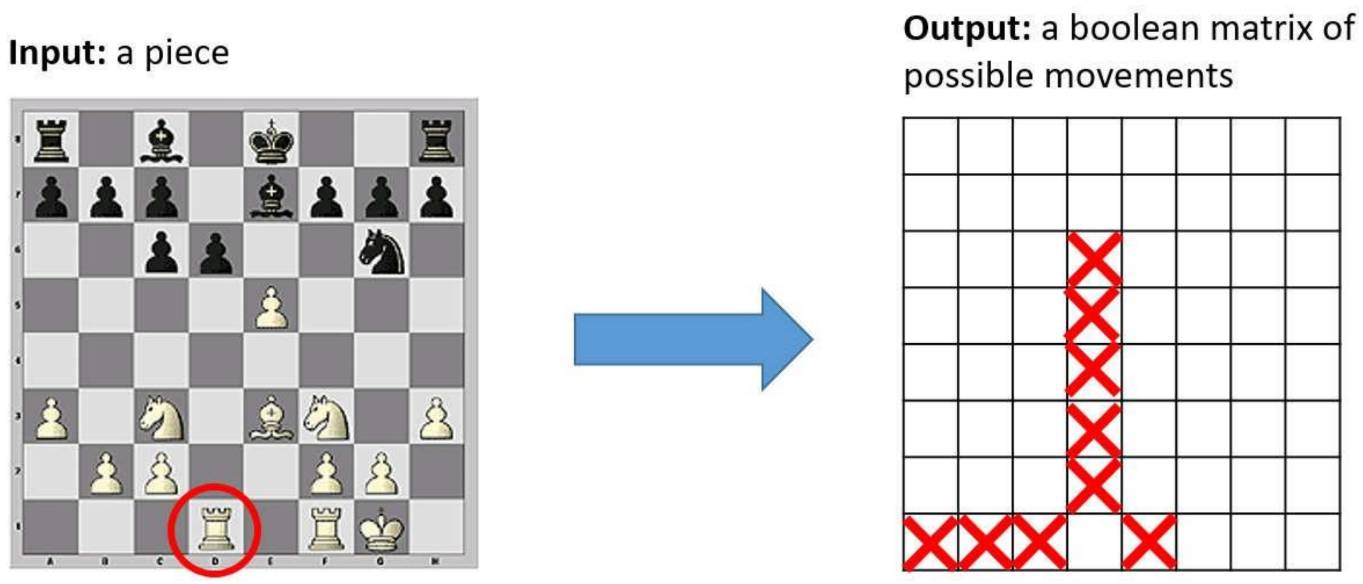
```
//  https://stackoverflow.com/questions/2979383/java-clear-the-console
public static void clearScreen() {
    System.out.print("\033[H\033[2J");
    System.out.flush();
}
```

Checklist:

- ChessException
- InputMismatchException

Possible moves of a piece





Checklist:

- Methods in Piece:
  - PossibleMoves [abstract]
  - PossibleMove
  - IsThereAnyPossibleMove
- Basic PossibleMove implementation for Rook and King
- Update ChessMatch.ValidadeSourcePosition

- **OOP Topics:**
  - Abstract method / class
  - Exceptions

Implementing possible moves of Rook

Checklist:

- Method ChessPiece.IsThereOpponentPiece(position) [protected]
- Implement Rook.PossibleMoves
- Method ChessMatch.ValidateTargetPosition
- **OOP Topics:**
  - Polymorphism
  - Encapsulation / access modifiers [protected]
  - Exceptions

Printing possible moves

Checklist:

- Method ChessMatch.PossibleMoves
- Method UI.PrintBoard [overload]
- Refactor main program logic
- **OOP Topics:**
  - Overloading

Implementing possible moves of King

Checklist:

- Method King.CanMove(position) [private]
- Implement King.PossibleMoves
- **OOP Topics:**
  - Encapsulation
  - Polymorphism

Switching player each turn

Checklist:

- Class ChessMatch:
  - Properties Turn, CurrentPlayer [private set]
  - Method NextTurn [private]
  - Update PerformChessMove
  - Update ValidadeSourcePosition
- Method UI.PrintMatch
- **OOP Topics:**
  - Encapsulation
  - Exceptions

Handling captured pieces

Checklist:

- Method UI.PrintCapturedPieces
- Update UI.PrintMatch
- Update Program logic
- Lists in ChessMatch: _piecesOnTheBoard, _capturedPieces
    - Update constructor
    - Update PlaceNewPiece
    - Update MakeMove
- **OOP Topics:**
    - Encapsulation
    - Constructors
- **Data Structures Topics:**
    - List

Check logic

Rules:

- Check means your king is under threat by at least one opponent piece
- You can't put yourself in check

Checklist:

- Property ChessPiece.ChessPosition [get]
- Class ChessMatch:
    - Method UndoMove
    - Property Check [private set]
    - Method Opponent [private]
    - Method King(color) [private]
    - Method TestCheck
    - Update PerformChessMove
- Update UI.PrintMatch

Checkmate logic

Checklist:

- Class ChessMatch:
    - Property Checkmate [private set]
    - Method TestCheckmate [private]
    - Update PerformChessMove
- Update UI.PrintMatch
- Update Program logic

Piece move count

Checklist:

- Class ChessPiece:
    - Property MoveCount [private set]
    - Method IncreaseMoveCount [internal]
    - Method DecreaseMoveCount [internal]
- Class ChessMatch:
    - Update MakeMove
    - Update UndoMove
- **OOP Topics:**
    - Encapsulation

Pawn

Checklist:

- Class Pawn
- Update ChessMatch.InitialSetup
- **OOP Topics:**
    - Encapsulation
    - Inheritance
    - Polymorphism

Bishop

Checklist:

- Class Bishop
- Update ChessMatch.InitialSetup
- **OOP Topics:**
    - Encapsulation
    - Inheritance
    - Polymorphism

Knight

Checklist:

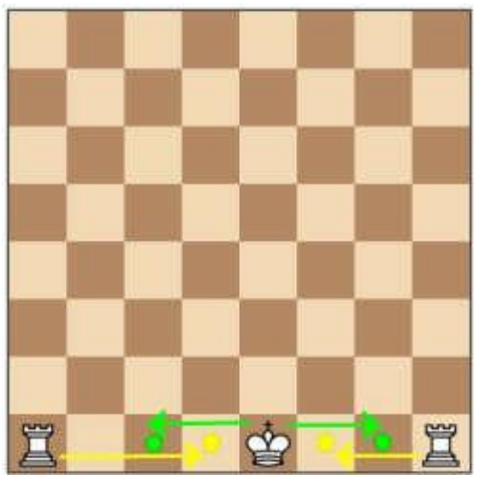
- Class Knight
- Update ChessMatch.InitialSetup
- **OOP Topics:**
    - Encapsulation
    - Inheritance
    - Polymorphism

Queen

Checklist:

- Class Queen
- Update ChessMatch.InitialSetup
- **OOP Topics:**
  - Encapsulation
  - Inheritance
  - Polymorphism

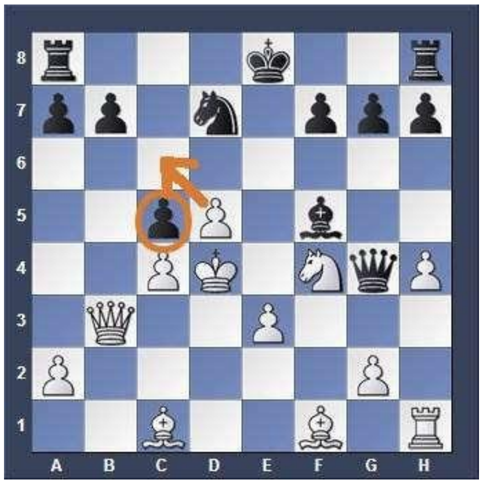
Special move - Castling



Checklist:

- Update King
- Update ChessMatch.MakeMove
- Update ChessMatch.UndoMove

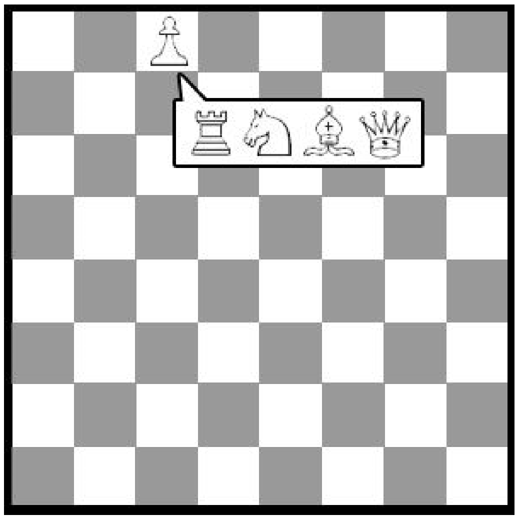
Special move - En Passant



Checklist:

- Register a pawn which can be captured by en passant on next turn
  - Property ChessMatch.EnPassantVulnerable
  - Update ChessMatch.PerformChessMove
- Update Pawn.PossibleMoves
- Update ChessMatch.MakeMove
- Update ChessMatch.UndoMove
- Update ChessMatch.InitialSetup

Special move - Promotion



Checklist:

- Property ChessMatch.Promoted
- Update ChessMatch.PerformChessMove
- Method ChessMatch.ReplacePromotedPiece
- Update Program logic