Software Construction HS 2021

Assignment 1

Exercise 1

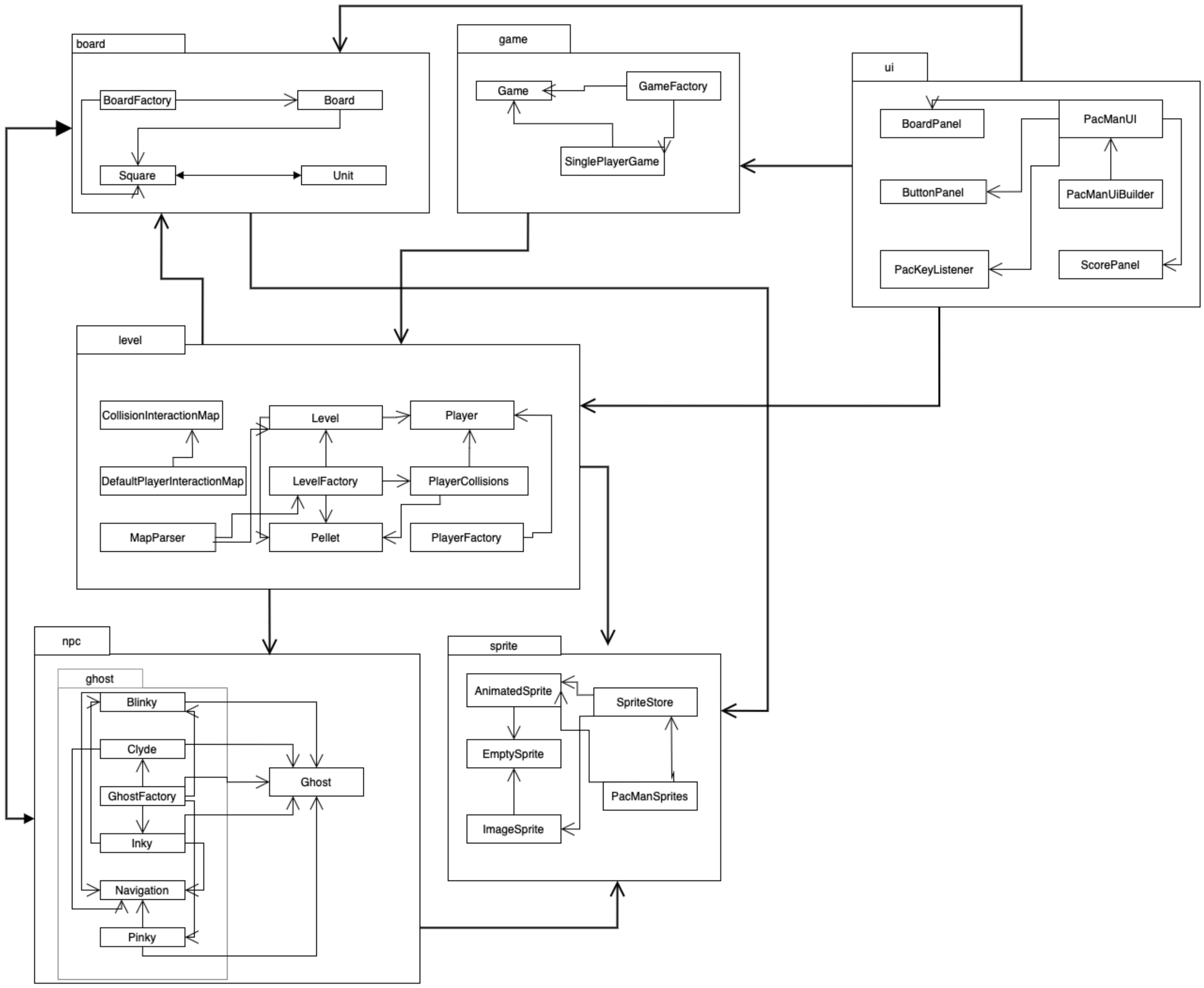
1. To draw the structure of the project’s packages and classes, we looked at the folders and files of the jpacman folder. This folder can be found here:

> *main -> java -> nl -> tudelft*

We decided to start there because in this folder the main packages and classes of the project can be found.

The *ui* package manages all the tools a user needs to play the game. It is connected with the *board* package which defines the play board. The board uses the *sprite* package in order to display the players correctly.

The *ui-package* is also connected with the *game* package which controls the start and ending of the game. This package then is connected with the *level* package which handles the rules and conditions of the game. The *level* package is further connected with the *npc* and *sprite* package. The *npc* package handles the different ghost's behaviour.


board
BoardFactory
Board
Square
Unit
game
Game
GameFactory
SinglePlayerGame
ui
BoardPanel
PacManUI
ButtonPanel
PacManUiBuilder
PacKeyListener
ScorePanel
level
CollisionInteractionMap
Level
Player
DefaultPlayerInteractionMap
LevelFactory
PlayerCollisions
MapParser
Pellet
PlayerFactory
npc
ghost
Blinky
Clyde
GhostFactory
Ghost
Inky
Navigation
Pinky
sprite
AnimatedSprite
SpriteStore
EmptySprite
PacManSprites
ImageSprite

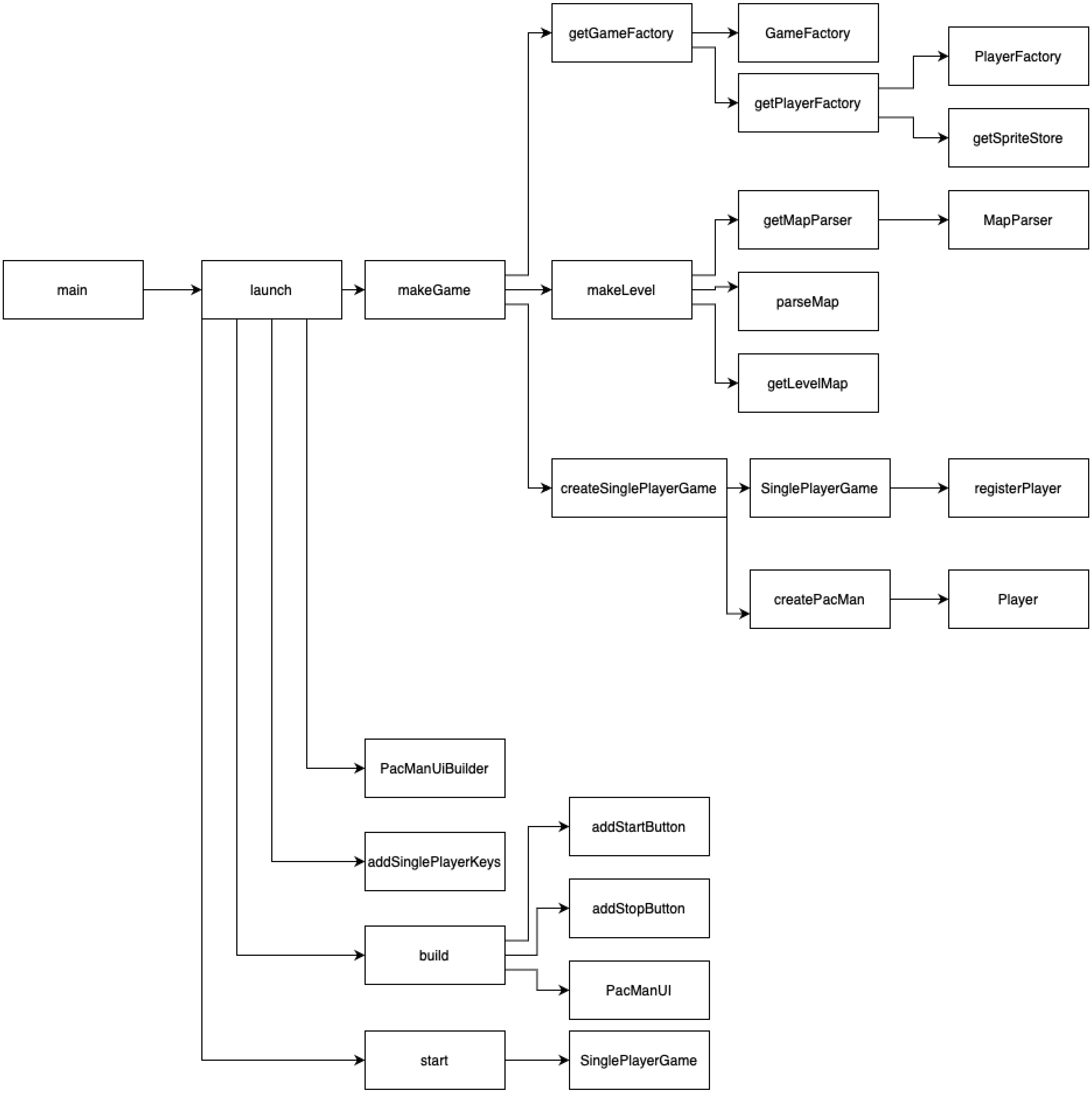
2. The call graph's entry point is the main function in the Launcher.java file. From there we explore up to 6 levels. We chose to use 6 levels because it shows the most important relationships while still keeping the call graph transparent.

The *main* method calls the *launch* method in the Launcher class. The launch method then calls several methods in the following order:

> *1. makeGame, 2. PacManBuilder, 3. addSinglePlayerKeys, 4. build, 5. start*

The *makeGame* method then calls the three methods *getGameFactory*, *makeLevel* and *createSinglePlayerGame* in order to create a new game. The 3 methods themself call again several methods which are needed to create the new game.

The *build* method then calls the methods *addStartButton*, *addStopButton* and *PacManUI* in order to build the UI for the above created new game. Then finally the start method of the *PacManUI* class is called and the game is displayed to the user.


main
launch
makeGame
getGameFactory
GameFactory
getPlayerFactory
PlayerFactory
getSpriteStore
makeLevel
getMapParser
MapParser
parseMap
getLevelMap
createSinglePlayerGame
SinglePlayerGame
registerPlayer
createPacMan
Player
PacManUiBuilder
addSinglePlayerKeys
build
addStartButton
addStopButton
PacManUI
start
SinglePlayerGame

Exercise 2

1. First we read the Checkers Game Requirements and the Checkers rules and highlighted the nouns in order to get a first idea what the classes could be. We then made the following list with the candidate classes:

   List of Candidate Classes

   - Board
   - Users
   - Moves
   - Input
   - Pawn
   - King
   - Validity *(of the move)*
   - Winner
   - Simple move
   - Single jump move
   - Multiple jump move
   - Round

   For each of these candidate classes we designed a CRC Card and defined its responsibilities. In order to do this we looked again at the text and the verbs corresponding to the previously highlighted nouns. We then discussed several scenarios in order to find relations between the classes and noted them on the CRC cards in the collaboration column. During the discussion we kicked some of the classes out or merged them with other classes.

Moves	
◦ to know the status of the board	Board
◦ to know who is playing(red or white)	Game

Validation	
to validate moves	Moves
to map rows, columns of all format to ~~player~~ 2D array	Mapper
to player info game state info	Game
to update game state if required	Board
to get col&rows from input	Utils

Utils

- get current and future positions
- get input from player

Mapper	
• to map rows & columns from board to 2D array to make calculations / use values later	

Game	
○ initalize board, update board, display board	Board
○ validate input, update game state	Validation
○ input move	utils

Board	
◦ maps raws, columns to get the game board	Mapper
◦ gets current & future positions of pawns/kings	Utils

2. Our main classes are **Game**, **Board**, **Validation** and **Moves**.

   The Game-class handles the input of the players and provides the UI. The UI consists of the game board, the input field and some messages. In order to initialize and update the game board, the *Game* class calls the *Board* class. In order to update the game board, the *Board* class calls the helper classes *utils* and *Mapper*.

   The *Game* class is further used to validate the input and to update the game state. In order to validate the move entered by the player, it calls the *Validation* class. The *Validation* class then checks the format of the move and calls the *Moves* class in order to check if the entered move is in the list of possible moves we get from the *Moves* class.

   The *Move* class gets, for a given move, all the possible moves. It handles all the rules of the moves. To do so, it needs some information from the *Game* class and from the *Board* class.

3. The *User* and *Input* class technically do the same, since there is no other information about the users than the move they entered. So we decided to put them together in the helper class called *utils*. This class is then called by the other classes in order to handle the input.

   The *Round* class is quite similar to the *Board* class. It simply updates the Board defined in the *Board* class. So we decided to put the functionality of the *Round* class into the *Board* class.

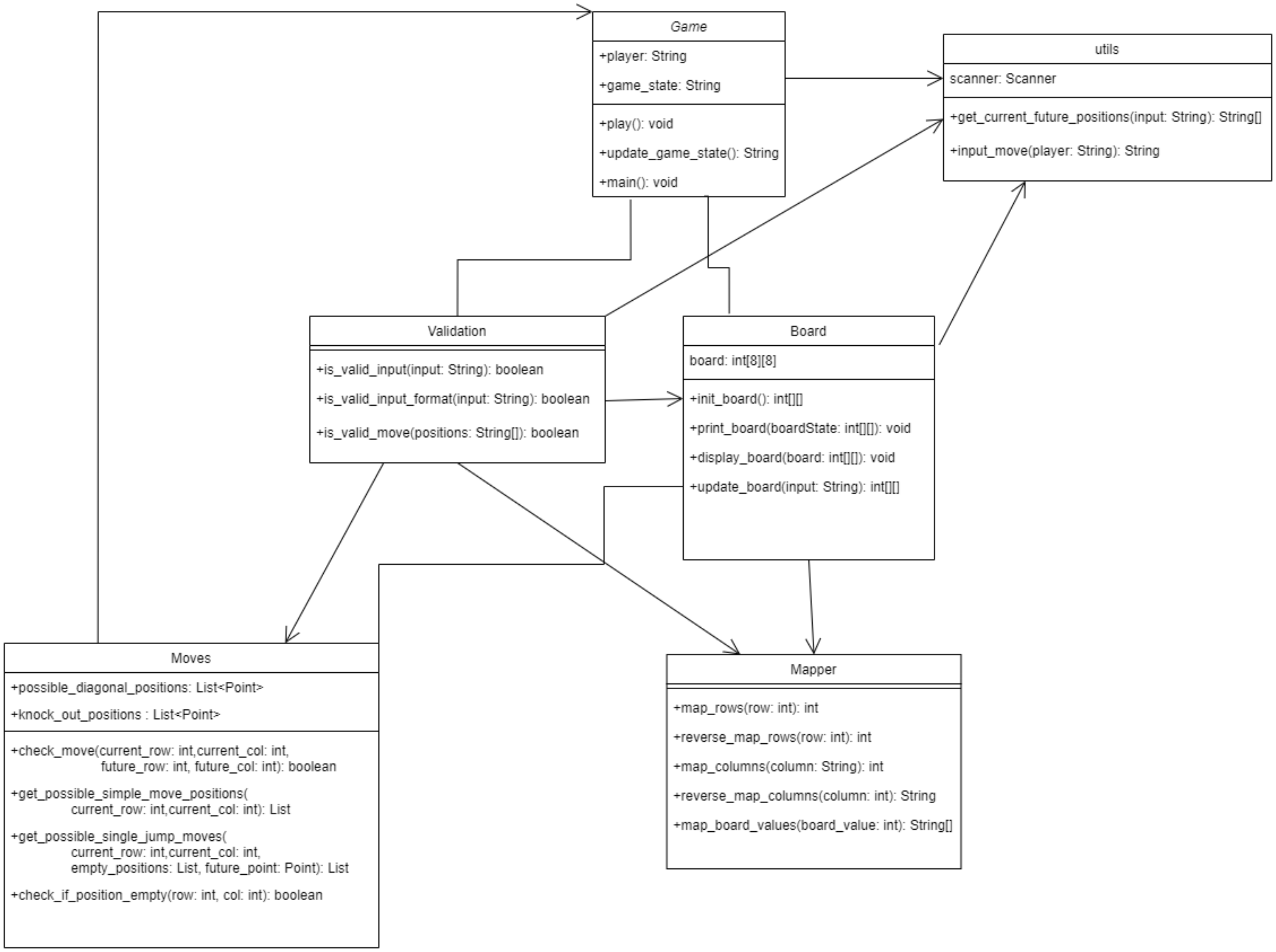
   The *King* and *Pawn* class are of no particular use since we store the positions of the pieces in the *Board* class. To update a pawn to a king we decided to use the *Board* class since there we already update the positions and type of the pieces.

   SimpleMove, *SingleJumpMove* and *MultipleJumpMove* classes are not needed since the rules for the moves are all handled in the *Moves* class.

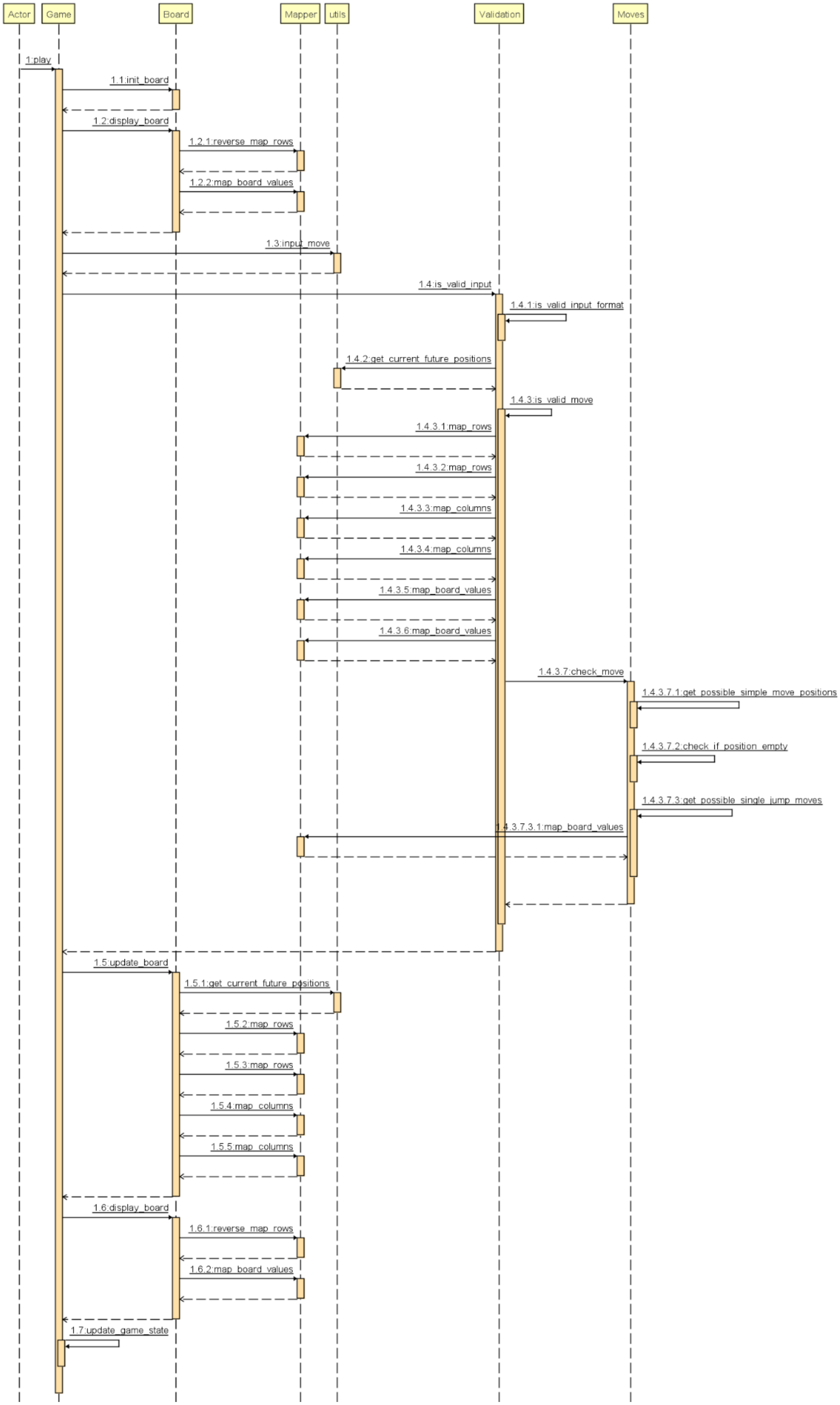
   The *Winner* class, where we initially wanted to check if the game is over or if it continues, was dropped and we have put this task into the *Game* class.

   We added two helper classes. The *utils* class reads the input from the user and gets the current and future positions of the pieces. The *Mapper* class helps to map the rows and columns from the board to a 2D-array which is used later to work with it. These two classes could as well be one class since they both provide smaller helping methods to the rest of the code.

4. Class Diagrams


Game
+player: String
+game_state: String
+play(): void
+update_game_state(): String
+main(): void
utils
scanner: Scanner
+get_current_future_positions(input: String): String[]
+input_move(player: String): String
Validation
+is_valid_input(input: String): boolean
+is_valid_input_format(input: String): boolean
+is_valid_move(positions: String[]): boolean
Board
board: int[8][8]
+init_board(): int[][]
+print_board(boardState: int[][]): void
+display_board(board: int[][]): void
+update_board(input: String): int[][]
Moves
+possible_diagonal_positions: List<Point>
+knock_out_positions : List<Point>
+check_move(current_row: int,current_col: int, future_row: int, future_col: int): boolean
+get_possible_simple_move_positions(current_row: int,current_col: int): List
+get_possible_single_jump_moves(current_row: int,current_col: int, empty_positions: List, future_point: Point): List
+check_if_position_empty(row: int, col: int): boolean
Mapper
+map_rows(row: int): int
+reverse_map_rows(row: int): int
+map_columns(column: String): int
+reverse_map_columns(column: int): String
+map_board_values(board_value: int): String[]

5. Sequence Diagram


Actor
Game
Board
Mapper
utils
Validation
Moves
1:play
1.1:init_board
1.2:display_board
1.2.1:reverse_map_rows
1.2.2:map_board_values
1.3:input_move
1.4:is_valid_input
1.4.1:is_valid_input_format
1.4.2:get_current_future_positions
1.4.3:is_valid_move
1.4.3.1:map_rows
1.4.3.2:map_rows
1.4.3.3:map_columns
1.4.3.4:map_columns
1.4.3.5:map_board_values
1.4.3.6:map_board_values
1.4.3.7:check_move
1.4.3.7.1:get_possible_simple_move_positions
1.4.3.7.2:check_if_position_empty
1.4.3.7.3:get_possible_single_jump_moves
1.4.3.7.3.1:map_board_values
1.5:update_board
1.5.1:get_current_future_positions
1.5.2:map_rows
1.5.3:map_rows
1.5.4:map_columns
1.5.5:map_columns
1.6:display_board
1.6.1:reverse_map_rows
1.6.2:map_board_values
1.7:update_game_state