

KONOBİ GAME

SOFTWARE DEVELOPMENT METHOD PROJECT

FALLACARA E., INDRI P., PIGOZZI F.

INTRODUCTION

The **goal** of our project is to implement the **Konobi game** in Java, giving also the user the opportunity to choose between two interfaces: **console version** or **GUI version**

Tools

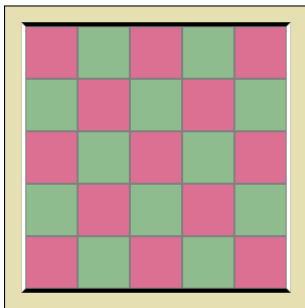
- ▶ IntelliJ;
- ▶ OpenJDK11 and JavaFX;
- ▶ GitHub;
- ▶ Gradle: building;
- ▶ TravisCI: continuous integrations;

KONOBI GAME

KONOBI

Konobi is a drawless connection game for two players: **Black** and **White**. It's played on a square board, which is initially empty.

The top and bottom edges of the board are coloured black; the left and right edges are coloured white.



KONOBI RULES

Starting with Black, the players take turns placing stones of their own color on empty points of the board, one stone per turn.

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KONOBI RULES

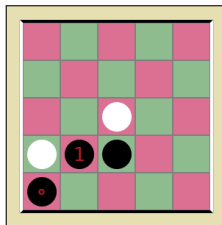
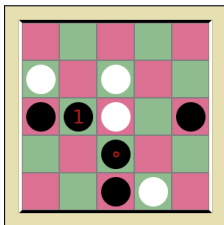
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Two like-coloured stones are **strongly connected** if they are orthogonally adjacent to each other, and **weakly connected** if they are diagonally adjacent to each other without sharing any strongly connected neighbour.

It's **illegal** to make a weak connection to a certain stone unless it's impossible to make a placement which is both strongly connected to that stone and not weakly connected to another.

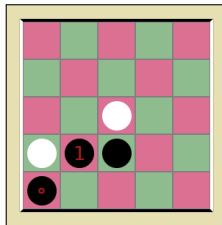
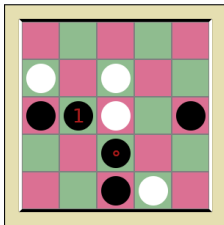
LEGAL AND ILLEGAL MOVES

Legal moves:

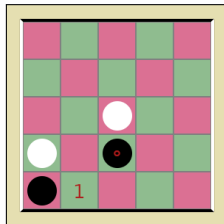
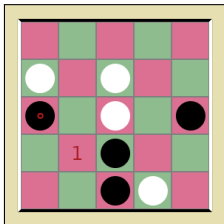


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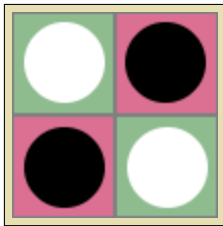


Illegal moves:



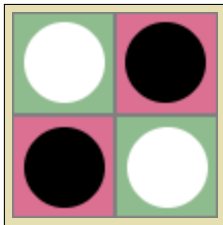
KONOBI RULES CONT.

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If a player can't make a move on his turn, he must **pass**. Passing is otherwise not allowed. There will always be a move available to at least one of the players.

KONOBI RULES CONT.

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The game is **won** by the player who completes a chain of his color touching the two opposite board edges of his color. **Draws are not possible.**

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- ▶ `UserInterface`.

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The **UI package**, on the other hand, contains all the elements that are used to create the two different user interfaces: **command line** and **desktop interface**.

CORE PACKAGE

BUILDING BLOCKS

Cell class is the fundamental building block of the game engine. It is associated to a **Colour**, and has a **Point** for the coordinates.

Board class is a collection of **Cells**, and implements the **Iterable** interface. It conveys a notion of geometrical arrangement among the **Cells**.

Player class represents each of the two players.

BUILDING BLOCKS - TDD

player second test and switch sides pigozzif committed 24 days ago ✓	46e534e	<>
player first test pigozzif committed 24 days ago	6d1909a	<>
Commits on Jan 23, 2020		
Cell coordinates test enricofallacara committed 25 days ago ✓	d2682b5	<>
Cell coordinates test enricofallacara committed 25 days ago	bb0106f	<>
Board size test enricofallacara committed 25 days ago ✓	02f1d33	<>
Board size test enricofallacara committed 25 days ago	009a3ce	<>
Fixed spacing pindri committed 25 days ago ✓	1937a0e	<>
Color test pindri committed 25 days ago ✓	63de5a7	<>
Coordinate test pindri committed 25 days ago ✓	898abac	<>
Coordinate test pindri committed 25 days ago	ce63025	<>
color test passed pindri committed 25 days ago ✓	5959eb3	<>

Test Driven Development was adopted from the very onset, committing after every red-light/green-light cycle.

SRP AND BOARD



SINGLE RESPONSIBILITY PRINCIPLE

Just Because You Can, Doesn't Mean You Should

```
52 public boolean isStrongNeighbour(Point target, Point query) {
53     return Arrays.stream(
54         slice(Math.max(0, p.y - level),
55             Math.min(p.y + level + 1, size),
56             Math.max(0, p.x - level),
57             Math.min(p.x + level + 1, size))
58     ).isAny();
59 }
60
61 public static boolean isStrongNeighbour(Point target, Point query) { return manhattanDistance(target.x, query.x, target.y, query.y) < 2; }
62
63 public static boolean isWeakNeighbour(Point target, Point query) { return manhattanDistance(target.x, query.x, target.y, query.y) < 3; }
64
65 @SafeVarargs
66 public final Stream<Cell> getNeighbours(Point point, int level, BiPredicate<Point, Point>... functions) {
67     return getMooreNeighbours(point, level).filter(cell -> Arrays.stream(functions).allMatch(x -> x.test(point, cell).getCo
68 )
69 }
70
71 @SafeVarargs
72 public final Stream<Cell> getColoredNeighbours(Point point, int level, Color color, BiPredicate<Point, Point>... functions) {
73     return getNeighbours(point, level, functions).filter(x -> x.hasThisColor(color));
74 }
75
76 public boolean isOnBoard(Point point) {
77     return 0 <= point.x && point.x < size && 0 <= point.y && point.y < size;
78 }
79
80 public boolean isBorderingEdge(Point point, Color color) {
81     return (color == Color.WHITE ? point.x == size - 1 : point.y == size - 1);
82 }
83
84 private static double manhattanDistance(int x1, int x2, int y1, int y2) { return Math.abs(x1 - x2) + Math.abs(y1 - y2); }
85 }
```

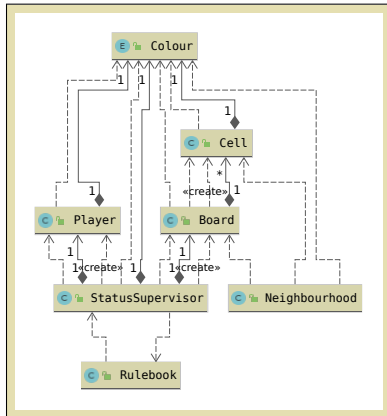
Board class was doing too much, so we performed an **Extract Class** refactor...

...and created the `Neighbourhood` class. It shows a **Monostate Pattern**, having only static methods to compute different flavours of neighbourhoods from an instance of `Board` and a target `Point`.

BUILDING BLOCKS CONT.

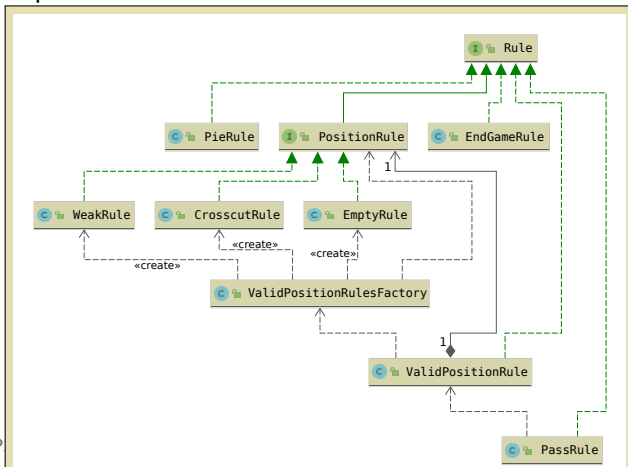
StatusSupervisor is in charge of holding the state of the game, and updating it whenever it changes (new move, pass rule, pie rule).

It is the middle-man that upper-level classes use to modify the status of the game.



RULES

The package **Rules** contains the true logic of the game. We started off by defining a class per rule, later to realize there was room for abstraction. We introduced **StatusSupervisor** as a **Preserve Whole Object**, allowing each of the classes to implement the **Rule** interface.



RULES CONT.

ValidPositionRule class had something wrong...

```
8 public class ValidPositionRule implements Rule {
9     private ArrayList<Rule> positionRules;
10
11     public ValidPositionRule() {
12         positionRules = new ArrayList<>(Arrays.asList(new EmptyRule(), new CrosscutRule(), new WeakRule()));
13     }
14
15     @Override
16     public boolean isValid(Supervisor supervisor) {
17         // TODO: spostare questo if in una nuova regola
18         if(!supervisor.getBoard().isOnBoard(supervisor.getCurrentPoint()))
19             return false;
20         return positionRules.stream().allMatch(x -> x.isValid(supervisor));
21     }
22 }
```



RULES CONT.

ValidPositionRule class had something wrong...

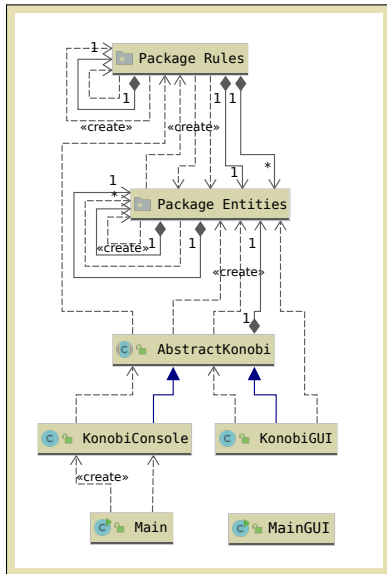
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```



Violation was solved creating ValidPositionRulesFactory class (which follows the **Factory Pattern**), and PositionRule interface to be used inside it.

AbstractKonobi provides an abstraction for the game itself, containing functions to check and apply the various rules; it is extended by:

- **KonobiConsole**;
- **KonobiGUI**.



UI PACKAGE

INTERACTING WITH THE GAME

At first, we considered abstracting the console and the graphical interfaces with a common Java interface.

We realised this was leading us to *conceptualisation abuse*.

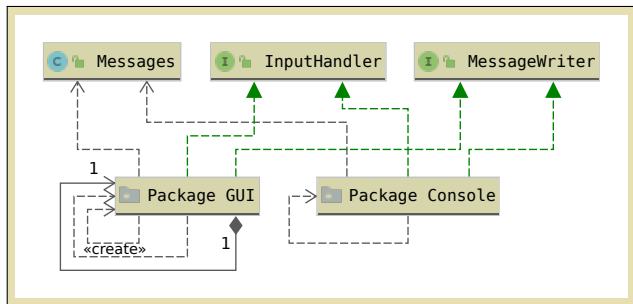
```
7  public interface UserInterface {  
8  
9      Point getInput(Player player);  
10     boolean askPieRule();  
11     void notifyEndGame(Player player);  
12     int askSize();  
13     void notifyPass();  
14     void display(Board board);  
15     void notifyInvalidMove();  
16     int initialize();  
17  
18 }
```

Implementation of `UserInterface` would have led to violations of the *SRP*.

The two interfaces are diverse enough, so we decided to create two distinct packages with different classes.

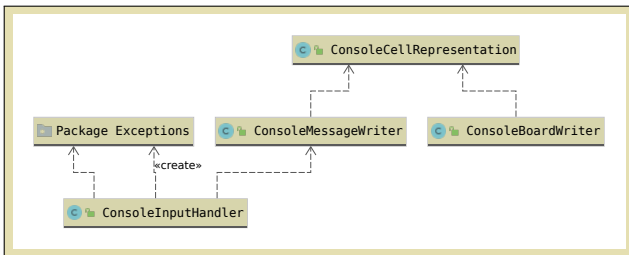
COMMON ELEMENTS

The two interfaces do have something in common. They use the same **Messages** and they both implement an **InputHandler** to ask the users for input and a **MessageWriter** to communicate with them.



CONSOLE USER INTERFACE

ConsoleBoardWriter handles the display of cells using **ConsoleCellRepresentation** to map the cell **Colour** to a symbol (convenient to avoid confusion with black/white console backgrounds).



GRAPHICAL USER INTERFACE

The **GUI** class implements the game flow in a JavaFX application. **GUIBoardWriter** deals with the creation of an empty grid and its update after each move.

The **Events** package defines events for the rules (pie, pass and end-game rules); the events are processed by the **Handlers** package, which handles mouse inputs as well.

At each mouse input, **GUIMouseInputHandler** fires the rule events using **EventsFactory**.

LONG METHOD SMELL IN GUI?

The GUI class is quite long: should this be regarded as a *Long method smell*?

```
117
118     Button rulesButton = createAndSetButton("Rules", width, height, (ActionEvent e) -> getHostServices().s
119
120     HBox hBox = new HBox();
121     hBox.getChildren().addAll(startButton, endButton, rulesButton);
122
123     pane.add(hBox, 0, 1);
124     hBox.setSpacing(15);
125     GridPane.setHalignment(hBox, HPos.CENTER);
126
127     Scene scene = new Scene(pane);
128
129     stage.setTitle("Konobi");
130     stage.setScene(scene);
131     stage.show();
132 }
133
134 @Override
135 public void stop() { Platform.exit(); }
136
137 public static void main(String[] args) { Application.launch(args); }
138
139 }
```

JavaFX applications are very verbose and (moderately) long methods should not be alarming.

STARTING GAME

For portability, the project is shipped with the `gradlew` (`gradlew.bat` for Windows) executable to run the code without manually handling dependencies.

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THANKS FOR YOUR ATTENTION

Thanks for your attention!

And now, let's test the project with a live demo.