

KONOBİ GAME

SOFTWARE DEVELOPMENT METHOD PROJECT

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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

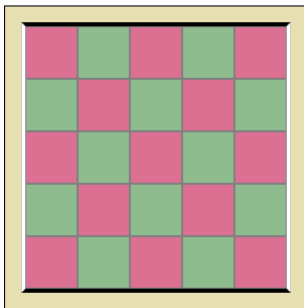
- ▶ IntelliJ;
- ▶ OpenJDK11 and JavaFX;
- ▶ GitHub;
- ▶ Gradle: building;
- ▶ TravisCI: continuous integrations;
- ▶ Other?

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

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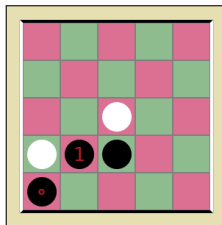
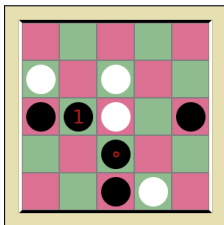
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Two like-coloured stones are **strongly connected** if they are orthogonally adjacent to each other, and **weakly connected** if they are diagonally adjacent to each other without sharing any strongly connected neighbour.

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.

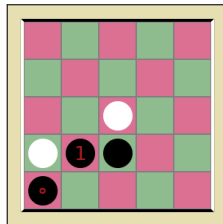
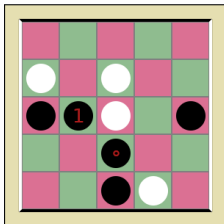
LEGAL AND ILLEGAL MOVES

Legal moves:

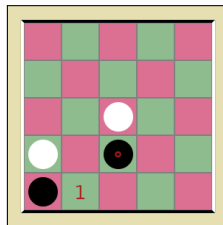
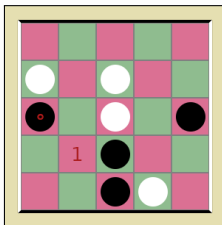


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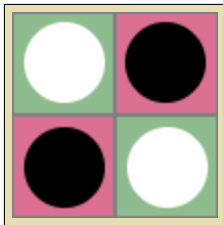


Illegal moves:



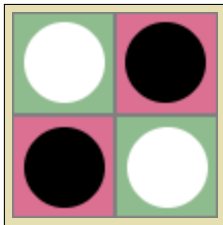
KONOBI RULES CONT.

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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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The **core package** contains all the elements concerning the functional logic of the game.

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 pattern.

SRP AND BOARD



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

Board class was doing too much, so we performed a **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 employed as an interface between the **UI** module and the **core** module, allowing the two to communicate without knowing anything of each other.

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**, and allowed each of the classes to implement the **Rule** interface.

Each **Rule** can be queried by passing a **Supplier** for it to the **Rulebook**.

ValidPositionRule class had something wrong...

```
8 public class ValidPositionRule implements Rule{
9     private ArrayList<Rule> positionRules;
10
11     public ValidPositionRule() {
12         positionRules = new ArrayList<Rule>(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.

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Violation was solved creating `ValidPositionRulesFactory` class, which follows the **Factory Pattern**.

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. **But we did use some abstractions.**

CONSOLE USER INTERFACE

- ▶ `ConsoleBoardWriter`: board display;
- ▶ `ConsoleCellRepresentation`: conversion between cell color and its representation;
- ▶ `ConsoleInputHandler`: player input handling, implements `InputHandler`;
- ▶ `ConsoleMessageWriter`: messages to the players, implements `MessageWriter`.

The `Exceptions` package handles exceptions.

Messages are contained in the `Messages` class: its messages are used by the GUI implementation as well.

GRAPHICAL USER INTERFACE

- ▶ **GUI**: implements the game flow in a JavaFX application;
- ▶ **GUIBoardWriter**: board and GUI display;
- ▶ **GUIAsker**: asks the user for interaction;
- ▶ **GUIMessageWriter**: messages to the players.

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.

LONG METHOD SMELL IN GUI?

GUI verbosity, code snippet.

STARTING GAME

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

The console version of the game can be started using:

```
> ./gradlew runConsole
```

The GUI version of the game can be started using:

```
> ./gradlew runGUI
```