Object-Oriented Programming 2

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Project

1 Project Description

The goal of this project is to implement a simple two-player game in Java. The game is developed in groups of two (except in case of an odd number of students, in which there will be a group of one). There are two deliverables:

Java Source Code

- Deadline: **Sunday, June 12th** (midnight)
- compilable and executable
- application runs properly
- coding conventions (class/variable/method names, private/protected/public, etc.)
- clean code (no unused variables, no warnings, proper use of data structures, etc.)
- JavaDoc
- tests

Presentation

- Date: **Tuesday, June 14th** (participation mandatory for everyone)
- 10–15 minutes (details follow)
- short demo
- overview of implementation (e.g. UML class diagram)
- interesting code snippets (e.g. observer pattern)
- extra features

2 Evaluation and Grading

The weight of the project is 25% of your final grade. You'll receive up to 5 point for the presentation, up to 15 points if all if all minimal features are implemented properly, and up to 5 points for extra features (max. 25 points).

Minimal Requirements

- game rules properly implemented
- human against human
- human against computer
- computer players with different strategies (max/min/random/greedy/protective/...)
- JavaFx user interface: visualisation of game board, scores, buttons, menu, etc.
- game statistics (XML)
- separation of user interface and application logic (MVC, observer pattern)

Extra features

- minimax algorithm (alpha-beta pruning)
- computer against computer (simulation)
- animations
- graphical statistics
- competition (more infos later)

3 Game Description

Uril is a two-player board game played in different parts of the world under different names (Ouril, Oril, Oware, Awal, etc.) and with different rules. In this project, we consider a simplified version of Uril.

Game Board and Basic Rules

The game board consists of two rows of six pits. Each row belongs to a player. The game starts with 4 seeds in each of the 12 pits (48 seeds total).

```
          +-+-+-+-+-+-+
Player B |4|4|4|4|4|4|
          +-+-+-+-+-+-+
Player A |4|4|4|4|4|4|
          +-+-+-+-+-+-+
```

The two players (call them A and B) play in turns. At each turn, the player chooses one of its pits (which must contain at least 1 seed) and distributes the seeds clockwise around the board.

Example: Player A starts the game and plays 2nd pit from the left

```
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
Player B |4|4|4|4|4|4|    |5|5|5|4|4|4|
          +-+-+-+-+-+-+ => +-+-+-+-+-+-+
Player A |4|4|4|4|4|4|    |5| |4|4|4|4|
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
```

Player B plays 6th pit from the left

```
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
Player B |5|5|5|4|4|4|    |5|5|5|4|4| |
          +-+-+-+-+-+-+ => +-+-+-+-+-+-+
Player A |5| |4|4|4|4|    |5| |5|5|5|5|
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
```

Player A plays 3rd pit from the left

```
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
Player B |5|5|5|4|4| |    |6|6|6|4|4| |
          +-+-+-+-+-+-+ => +-+-+-+-+-+-+
Player A |5| |5|5|5|5|    |6|1| |5|5|5|
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
```

Player B plays 3rd pit from the left

```
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
Player B |6|6|6|4|4| |    |6|6| |5|5|1|
          +-+-+-+-+-+-+ => +-+-+-+-+-+-+
Player A |6|1| |5|5|5|    |6|1| |6|6|6|
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
```

Goal and End of Game

The goal of the game is to "eat" seeds on the opponent's pit row. Only single seeds in a pit can be eaten. Seeds can be eaten by placing a second seed into the pit. If this happens, both seed are removed from the board.

Example (cont.): Player A plays 1st pit from the left and eats B's seed in the 6th pit from the left. The score now is 1:0 in favour of A and 46 seeds remain in the game.

```
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
Player B |6|6| |5|5|1|    |7|7|1|6|6| |
          +-+-+-+-+-+-+ => +-+-+-+-+-+-+
Player A |6|1| |6|6|6|    | |1| |6|6|6|
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
```

Player B plays 5th pit from the left and eats A's seed in the 2nd pit from the left. The score now is 1:1 and 44 seeds remain in the game.

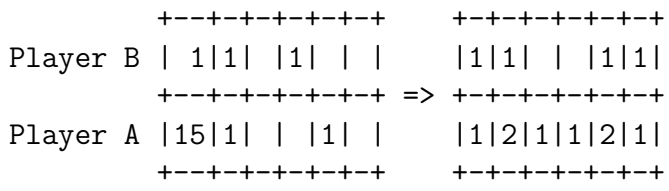
```
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
Player B |7|7|1|6|6| |    |7|7|1|6| |1|
          +-+-+-+-+-+-+ => +-+-+-+-+-+-+
Player A | |1| |6|6|6|    | | |1|7|7|7|
          +-+-+-+-+-+-+    +-+-+-+-+-+-+
```

The game ends if only 2 seeds remain in the game. The possible final scores are: 0:23, 1:22, 2:21, ..., 10:13, 11:12, 12:11, 13:10, ..., 21:2, 22:1, 23:0. Note that there is always a winner. Also, as long as at least 4 seeds remain in the game, there is always a strategy to avoid an endless loop.

Remarks:

- Sometimes, more that one seed can be eaten simultaneously in different pits of the opponent.
- It can happen, that all pits of Player A are empty, in which case B can play twice or multiple times, until A gets at least one seed back from B.
- There is no upper bound for the number of seeds in a pit. It can actually happen that a large number of seed are in the same pit. In such a case, distributing the seeds may go over more than one full round.

Example (cont.): A plays 1st pit form left and eats 4 seeds of B (the 3 seeds in pit 1, 2, and 4, plus a seed in pit 3)


Player B
Player A
=>