CITS3001 Algorithms, Agents and Artificial Intelligence

Labsheet 7: *Das Bohnenspiel* – Assessed

This lab sheet is worth 3% of CITS3001. You should implement Java solutions to the following problems and you should submit them at *cssubmit* by 5pm on Sunday 13 September. In accordance with the UWA Policy on Academic Conduct, you may discuss with other students the general principles required to understand this labsheet, but the work you submit must be the result of your own effort.

- A set of simple built-in *Bohnenspiel* players is provided in *BohnenspielPlayerBuiltin.java*. We will test your submission against these players and against other (better!) players that we will add later.
- A reasonable amount of time will be allowed for your program to run: assume around 10 milliseconds per move. Submissions that run too slowly will be terminated before they complete.
- Submissions that do not compile will earn zero marks. Submissions that have to be edited before they execute will be penalised, and may get zero.
- Normally your mark will depend only on the results produced by your program, but all programs will be compared for similarity with other submissions and with sources drawn from the Internet.
- All questions to *help3001* please.

Download the Lab 7 folder from the LMS, and complete the method in the *BohnenspielPlayer* class in the code skeleton. You can run it in two ways.

- If you run the *main* method in the *Lab7* class, your player will be tested against the built-in players and a score will be returned.
- If you create an object of class *Lab7*, you will be prompted for a colour (either *Farbe.WEISSE* or *Farbe.SCHWARZ*) and then you will be able to play a game against your player. The splash screen gives instructions.

Submit only the file *BohnenspielPlayer.java* by the due date above. If you modify any of the other classes, make sure that *BohnenspielPlayer.java* works with the original version.

If during a game, any player ***ever*** returns an illegal move, that game is immediately forfeit. Be careful!

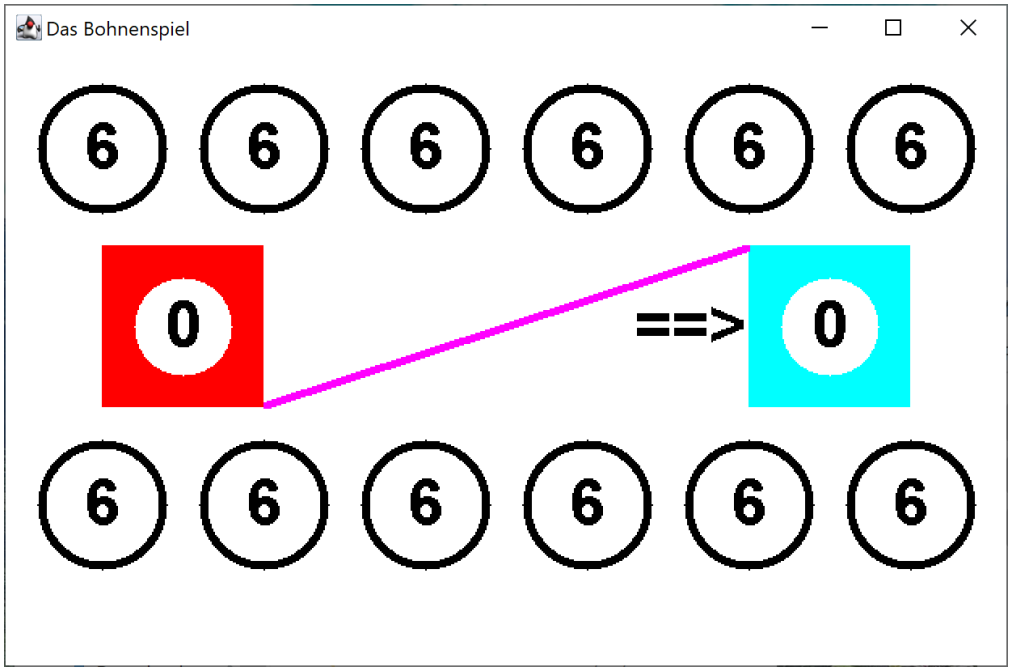
There is a prize available* for Lab 7, separate to the assessment itself. ***If it is feasible to organise***, there will be a tournament to which some number of players will be invited, and prizes will be distributed according to the AI's performance at that tournament. Details will be announced nearer the time.

*All prizes are awarded or not at Lyndon's sole discretion.

The Rules of *Das Bohnenspiel*

The game is played between *Weisse* and *Schwarz* on a board with two rows of six *houses*, plus two *stores*. Each player owns the six houses nearer to them, plus the store on their right. Initially, both stores are empty, and each house contains six beans. The initial position is shown in Figure 1.

Schwarz



Weisse

Figure 1. The initial position. Circles are the houses, and coloured squares are the stores. The twelve houses should be viewed as sitting on a loop around the board. The numbers denote the beans in each house and store, and the arrow indicates the next player to move.

Players alternate moves, with *Weisse* going first. Each move has two stages.

1. The player selects one of their own houses *h* that contains one or more beans, and they *sow* those beans one at a time in the houses anti-clockwise from *h*, starting from the house on the right of *h*.
2. After sowing is complete, if the final house *j* in which a bean is sown contains ***two, four, or six*** beans, those beans are captured and are moved to the player's store. If any capture is made in house *j*, the series of houses clockwise from *j* are examined (and possibly captured) repeatedly in the same way until a house is not captured.

Figure 2 shows a series of moves from the initial position, with no captures. Figure 3 shows a simple one-house capture, and Figure 4 shows a compound move with three houses captured.

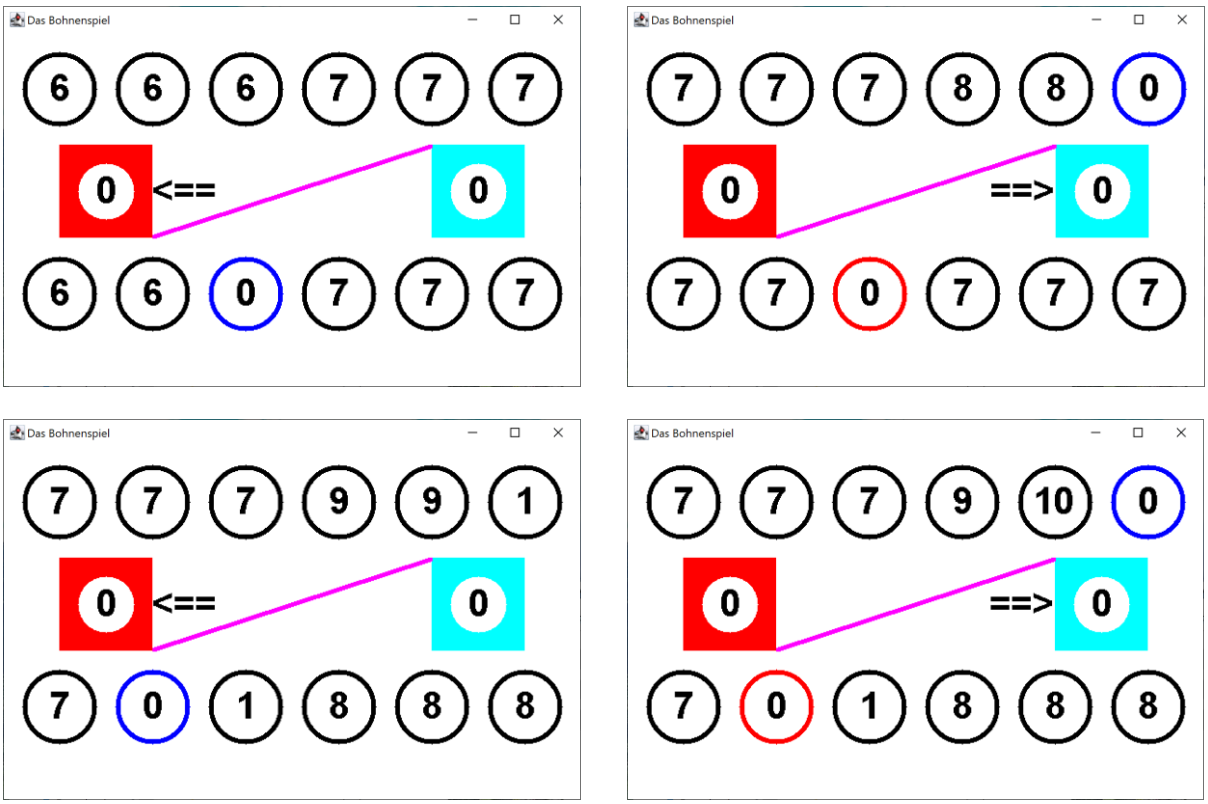


Figure 2. A series of moves from the initial position. In each image, the blue circle denotes the house that was moved from, and red circles denote houses that are empty after the move, so are unavailable for the next move.

A game can end in two ways. Note that a draw is possible.

- If either player accumulates in their store more than half of all the beans, the game ends immediately and that player wins.

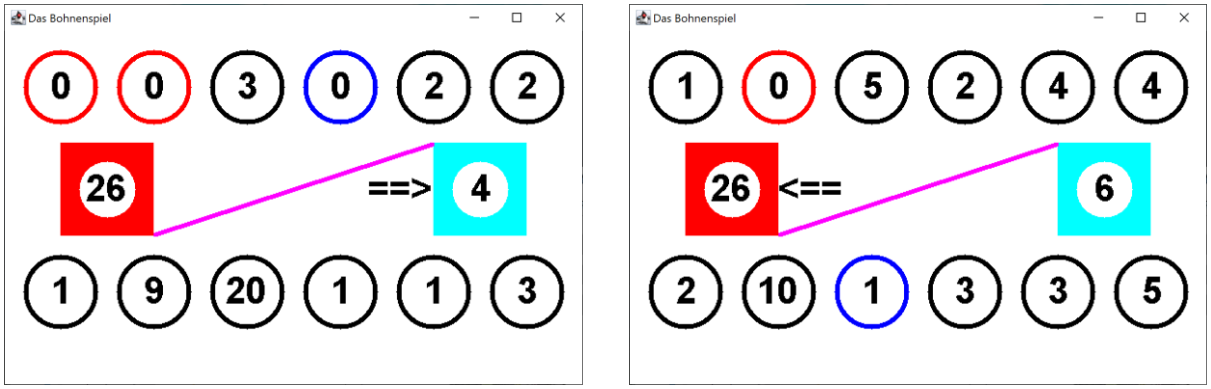


Figure 3. A move where one house is captured. In the position on the left, *Weisse* selects the third house from their left (with twenty beans), sows them in the twenty houses anti-clockwise from there (circling the entire board), then captures the two beans left in the final house sown (the one that is red in the right image). Two beans are thus added to their store.

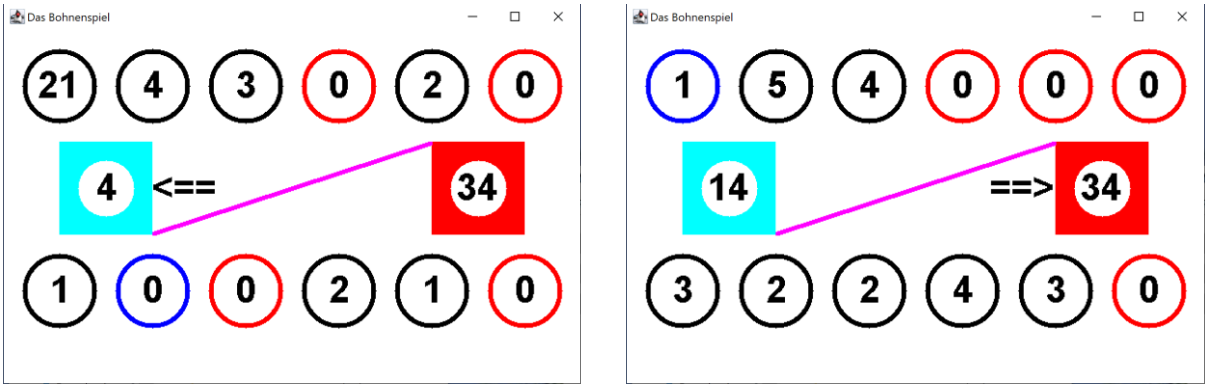


Figure 4. A move which captures four houses. In the position on the left, *Schwarz* selects the house at the top-left of the board (with twenty-one beans), sows them in the twenty-one houses anti-clockwise from there, then captures the beans in the last four houses sown (the red ones in the right image). Ten beans are thus added to their store: 2+4+2+2. The house with three beans near the bottom-right prevents the captures going any further.

- If either player has zero beans in all six of their houses, all beans remaining in all houses are moved to the opponent's store, the game ends, and the winner is the player whose store contains more beans.

You can read more about the game at https://en.wikipedia.org/wiki/Das_Bohnenspiel and elsewhere, but where there may be minor differences in the rules, **this document is definitive for Lab 7**.

Try out the game using the code skeleton, and send any questions to *help3001*.