PFL TP2 2024-2025

The Topic and Group Identification

This group (LOT_1) is constituted by, and each member's respective contribution is:

- Alexandre António Pinho da Silva - 47.5%
- Eduardo Ferreira Baltazar - 47.5%
- Sofia Alexandra Mesquita Carvalho de Sousa - 5%

Even though our group is of 3 people, we were not able to implement the features specific to this group size, as one of the members did not contribute to the coding part of the project, only having contributed towards this Readme file.

Our group's chosen game was LOT.

Instalation and Execution

In addition to the the installation of SICStus Prolog 4.9, there is no other installation to be done.

To run the project simply run:

```
sicstus -l src/game.pl
```

To play the game, one should use the play/0 predicate (`play.`).

Game Description

We used the rules from the official website, available at https://nestorgames.com/rulebooks/LOT_EN.pdf

LOT is played on an orthogonal grid of 7 x 7 squares. Two players, black and white, struggle to create a line of three consecutive stacks of 2 pieces each in any direction (orthogonal or diagonal).

Players alternate turns during the game until one of them reaches the victory condition.

On your turn, do the following in order: 1. Lay out a thing on an empty lot: Place a piece of your colour on an empty space of the board. 2. Look over that: If at least one line of three or more consecutive pieces (not stacks) in any direction (orthogonally or diagonally) of your colour has been created then you must do the following in or- der: a. Choose one of the lines of three that have been created and remove two pieces, but leave one there. b. Add one level of tower, by adding another piece of yours to the one you left there, making it a stack.

If, at the end of the turn, at least one line of three (or more) consecutive stacks of the same colour has been created, the line's owner triumphs. If the board fills up before this happens the game ends in a draw.

Considerations For Game Extensions

The game can be played on different sized boards, and this is available to users when starting the game. They are given the choice between playing with the default board size, or a size of their choice.

This game's rules are so simple that it would be hard to simplify them without loosing the interest of the game. But, if one wanted to do this, the rule of 3 pieces create a stack could be changed to 2 pieces create a stack.

To make the game harder, one could do the opposite, to make the pieces to make a stack larger than 3. Or even, make the win condition stacks 3 high, instead of 2 high.

Game Logic

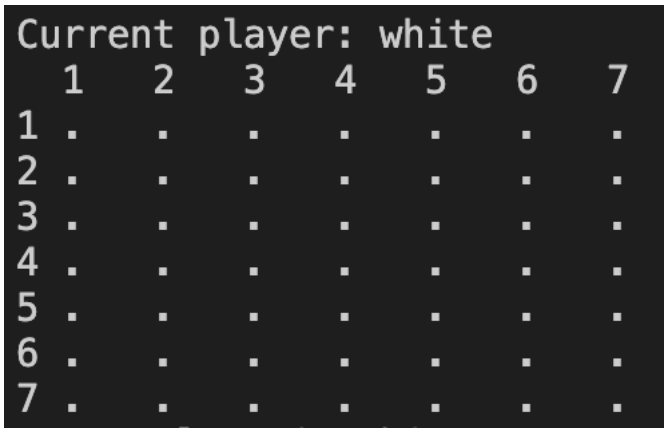
Game Configuration Representation

To represent the game internally, we use a State. This is composed by the current board, the current player, and the current game mode. The current board is a a list with X sublists, who have X items, with X being the size of the board. Each item can be an empty space, a white piece, a black piece, or a stack of white or black pieces. The current player is either white, or black. The game mode is a number from 1 to 4, with each being, respectively, Human-Human, Human-AI, AI-Human, AI-AI. The initial_state/2 predicate takes a GameConfig, which is a tuple of (Size, GameMode), and it "returns" a GameState, of the type we have previously mentioned.

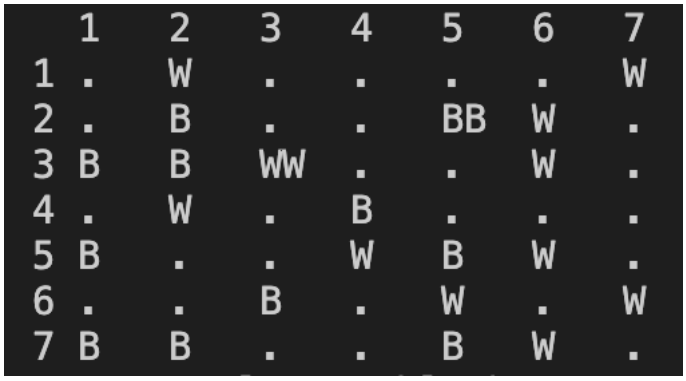
Internal Game State Representation

The game configuration represents the static properties required to define the game setup, such as the board size, initial piece arrangement, and the number of players. Internally, this is stored using structured data like lists or tuples, which are passed to the initial_state/2 predicate to generate the initial game state. The game state itself captures dynamic information, including the current board layout, active player, and game mode, using a compound term like state(Board, Player, Mode). Moves are represented as structured terms, such as move(X, Y), denoting the transition of a piece from one position to another, and are validated and applied by the move/3 predicate. User interaction is facilitated through a menu-driven system, ensuring clear communication and a seamless user experience.

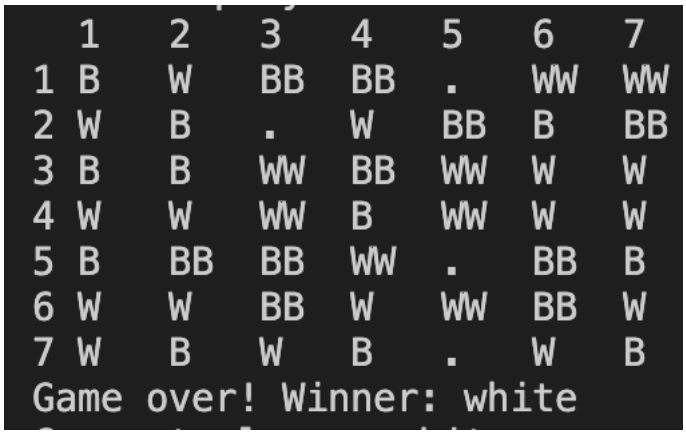
Initial game state:



Intermediate game state:



Final game state:



Move Representation

User Interaction

The game features a menu-driven system to guide the user through various options, such as starting a new game, choosing options, making moves, or exiting the application. Interaction with the user is handled via prompts and text-based input, ensuring clarity and ease of use. Input validation is a key aspect, particularly when reading moves; the system checks for valid formats, ensures the inputs are within the bounds of the board, and verifies that the move adheres to the game's rules. Invalid inputs trigger descriptive error messages, prompting the user to re-enter their choices until valid input is provided, thereby maintaining a smooth and error-free gameplay experience.

Conclusions

This project still has some rough edges, and is not completely error-ridden. Some of the known bugs are:

In the future, a better algorithm could be implemented for a higher level of AI (min-max), and alternative rules could also be implemented.

Bibliography

The only bibliography used for this project were the game rules, which are linked above in the Game Description section.

We also artificial intelligence, namely ChatGPT for bug finding and solving, and sometimes to better understand some abstract concepts inherent to the game and to the Prolog. We do not include here the prompts that were used, as it would make this document longer than it is required to be (4 pages).