FACULDADE DE ENGENHARIA DA UNIVERSIDADE DO PORTO

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Echek

Programação em Lógica
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3MIEIC02_Echek_2:

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Introduction

This project is being developed in the SICStus Prolog Development System, and is the the first of a two part project regarding the course Logic Programming (Programação em Lógica), a 3rd year course of the Integrated Masters Degree in Informatics and Computing Engineering (MIEIC). The aim of this project is to develop a board game using the programming language Prolog, based on moving pieces (possible moves) and win/defeat conditions (final states).

Game Description

History

Echek is part of a 5 board games collection called Cut and Play: Collection of free micro games created by Léandre Proust in 2019. It was first introduced on kickstarter and has over 600 backers who have pledged over €4000 to help bring this collection to life. This collection is composed of: Echek, Exo, YSNP, Ants and Supéro.

**Picture 1:** Cut and Play: Collection of free micro games

The goal of this collection was to offer games with simple rules, little material and easy to make. Since the beginning of 2019, Proust has created and published a new minimalist board game each month: Echek on February, Exo in March, YSNP in April, Ants in May and Supéro in June. 20 000 copies of these games were printed and distributed for free in France by Philibert, the French leader in board games sales.

Rules

Echek is a chess-inspired game which is played with only 12 cards and without an actual board. Each player has 6 pieces (King, Queen, Tower, Bishop, Horse, and Pawn) with chess-like moves and they play on a 4x4 dynamic board. The game begins with both Kings face to face, and each turn players can move a piece or put a piece into play. The game ends when a King is surrounded by 4 pieces.

Placing and Moving

Placing: The player chooses a piece from his hand and places it in the playing area. It must be placed next to (by one side or by one corner) one of his pieces already in game. It can't be placed on one of the 4 squares adjacent to the opposing King.
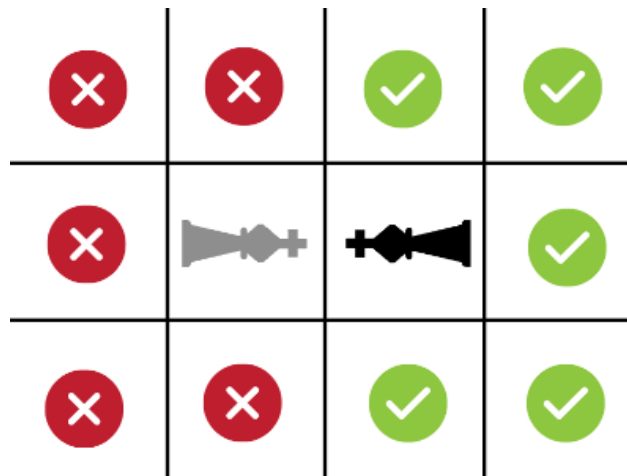
Picture 2: Early game moves

Moving: The player chooses one of his pieces already in the playing area and moves it according to the rules of this piece. After moving, <u>all the pieces in game must always be connected</u> by a corner or a side, otherwise the move is not allowed.

Pieces - Movements and special powers

A <u>Pawn</u> can move one square horizontally or vertically. When this piece is placed in the playing area, it can immediately move.

A <u>Knight or Horse</u> in Echek, just like the Knight in Chess, moves to a square that is two squares away horizontally and one square vertically, or two squares vertically and one square horizontally. The complete move therefore looks like the letter "L". It can jump over all other pieces to its destination square.

A <u>Tower</u> can move any number of squares horizontally or vertically. If this piece is in the playing area, only once per game, you can spend your turn to swap it with your king (exchange their positions). Similar to the rook move in Chess.

A <u>Bishop</u> can move any number of squares diagonally. This piece may exceed the borders of the playing area (it is not considered in the borders of the playing area).

A <u>King</u> can move one square in any direction (horizontally, vertically, or diagonally). When this piece is surrounded, you lose the game.

A <u>Queen</u> can move any number of squares in any direction (horizontally, vertically, or diagonally). When this piece is surrounded you lose it, removing it permanently from the game.

Pieces that move any number of squares (Queen, Tower or Bishop) can not jump over pieces of the opposing color, with the exception of the Horse, but they can jump over pieces of the same color to get to its destination square.
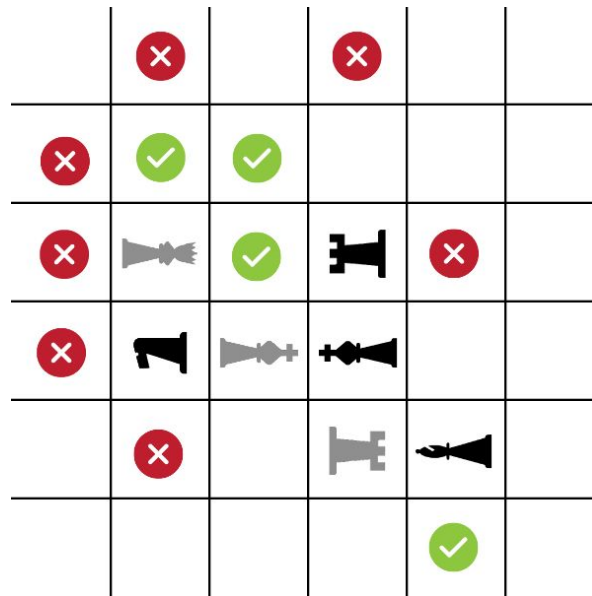
Picture 3: Possible white Queen moves

Ending a Match

The game ends as soon as a King is surrounded on all four sides (up, down, left, and right) by pieces of any color or by the border of the game area. The player whose king is surrounded loses the game.

Notes about the rules

In the rules when the board shrunk from a 4x4 to a 3x4 by having its left column removed, for example, it was not clear whether the only way to restore it to its full size (4x4) was to reinstate that missing column or, in addition to that possibility, we could add a new column on the right side, by moving a piece there.

Since we weren not getting a definitive answer on that, we decided to contact the game's creator, *Leandre Proust*. He was more that happy to help and was also very excited we were making a "dematerialized version", as he put it, of his game. He explained that the board could grow in any direction, after having being shrunk.

In addition, he asked if we could provide, when completed, a running version of the game. Since the game is being written in prolog and has no graphical interface, we don't think Leandre will know what is coming.

Game Implementation in Prolog

Game Representation

Mentioned previously, Echek is played on a 4x4 dynamic board, which means that the board is not stationary and it can grow or shrink depending on the positioning of the pieces. This introduces a new challenge when defining the board.

Initial State

```
initialBoard([
    [kingBlack],
    [kingWhite]
]).
```

Intermediate State

```
intermediateBoard([
    [empty, empty, bishopBlack],
    [towerBlack, kingBlack, towerWhite],
    [empty, kingWhite, empty],
    [queenWhite, horseBlack, empty]
]).
```

Final State

```
finalBoard([
    [empty, queenBlack, empty, empty],
    [towerBlack, kingBlack, towerWhite, bishopBlack],
    [empty, kingWhite, empty, empty],
    [queenWhite, horseBlack, empty, horseWhite]
]).
```

Board Preview in Text Mode

Initial State

```
        | 1 |
     ---|---|
      A | k |
     ---|---|
      B | K |
     ---|---|
```

Picture 4: Board initial state

Intermediate State

```
        | 1 | 2 | 3 |
     ---|---|---|---|
      A | . | . | b |
     ---|---|---|---|
      B | t | k | T |
     ---|---|---|---|
      C | . | K | . |
     ---|---|---|---|
      D | Q | h | . |
     ---|---|---|---|
```

Picture 5: Board intermediate state

Final State

```
        | 1 | 2 | 3 | 4 |
     ---|---|---|---|---|
      A | . | q | . | . |
     ---|---|---|---|---|
      B | t | k | T | b |
     ---|---|---|---|---|
      C | . | K | . | . |
     ---|---|---|---|---|
      D | Q | h | . | H |
     ---|---|---|---|---|
```

Picture 6: Board final state