SPIEL BOARD GAME LANGUAGE

An educational domain-specific language for describing board games to teach computing in middle school science classrooms.

Spiel Language

1. game TicTacToe
2. gameStart :: Board -> Spiel
3. boardPositions :: Board -> Spiel
4. initialBoard :: Board
5. initialBoard (Positions) -> Empty
6. isFirst :: Player
7. isFirst -> A
8. gameOver :: Board -> Bool
9. gameOver (h) -> [stringInRow(h), isEmpty(h)]
10. outcome :: (Board, Player) -> (Player, Tie, Continue)
11. outcome (h, p) = (stringInRow(h), isFull(h) then B else if (p) then Tie else Continue)
12. threeInARow :: Board -> Bool
13. threeInARow (h) = stringInRow(h) then B else if isFull(h) then Tie else Continue
14. stringInRow (h) = [stringInRow(h), isEmpty(h)]

Predefined operators:

- Game ending: game-over condition and game outcome
- GameStart: board initialization
- Board positions: initial board
- Is first: player initialization
- Game over: condition check
- Outcome: board, player -> (player, tie, continue)
- Three in a row: board -> bool

Fig 2: The Spiel web-interface provides a helpful editor for writing board game descriptions. It is also designed to support fill-in lesson files where the user can learn small portions of the syntax at a time.

PROBLEM

Teaching computer science and software engineering is difficult. While common first programming languages such as C++, Java, and JavaScript are powerful tools, they introduce unnecessary complexity for any beginner, and especially for the middle school student.

Despite the hard learning curve, computer literacy is one of the most important skills in the contemporary era. Practitioners of every field use software for their daily work and many of them require or soon will require a basic level of algorithmic ability, so it has personal and economic value.

Our goal is to facilitate computer science and software engineering education with a simpler programming language.

SOLUTION

- Our solution is Spiel, a domain-specific programming language for the specification and play of board games.
- Board games are easy to learn and familiar to middle school students. They are also very deterministic, meaning that they are great for teaching algorithmic thinking.
- We created an interpreter, editor, read-evaluate-print loop, and visual interface for playing the games.
- We also created example programs and corresponding curriculum which gradually teaches our language.
- It will be used in sixth and seventh grade classrooms at Linus Pauling Middle School.

LANGUAGE DESIGN

- Spiel has board-game specific prelude functions to support the domain.
- Spiel is a purely functional language with simple syntax.
- The result of any given function is only decided by its inputs.
- Students can focus on the intended algorithmic description conveyed in the functions without considering side-effects.

THE TEAM

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