Spider Line 4

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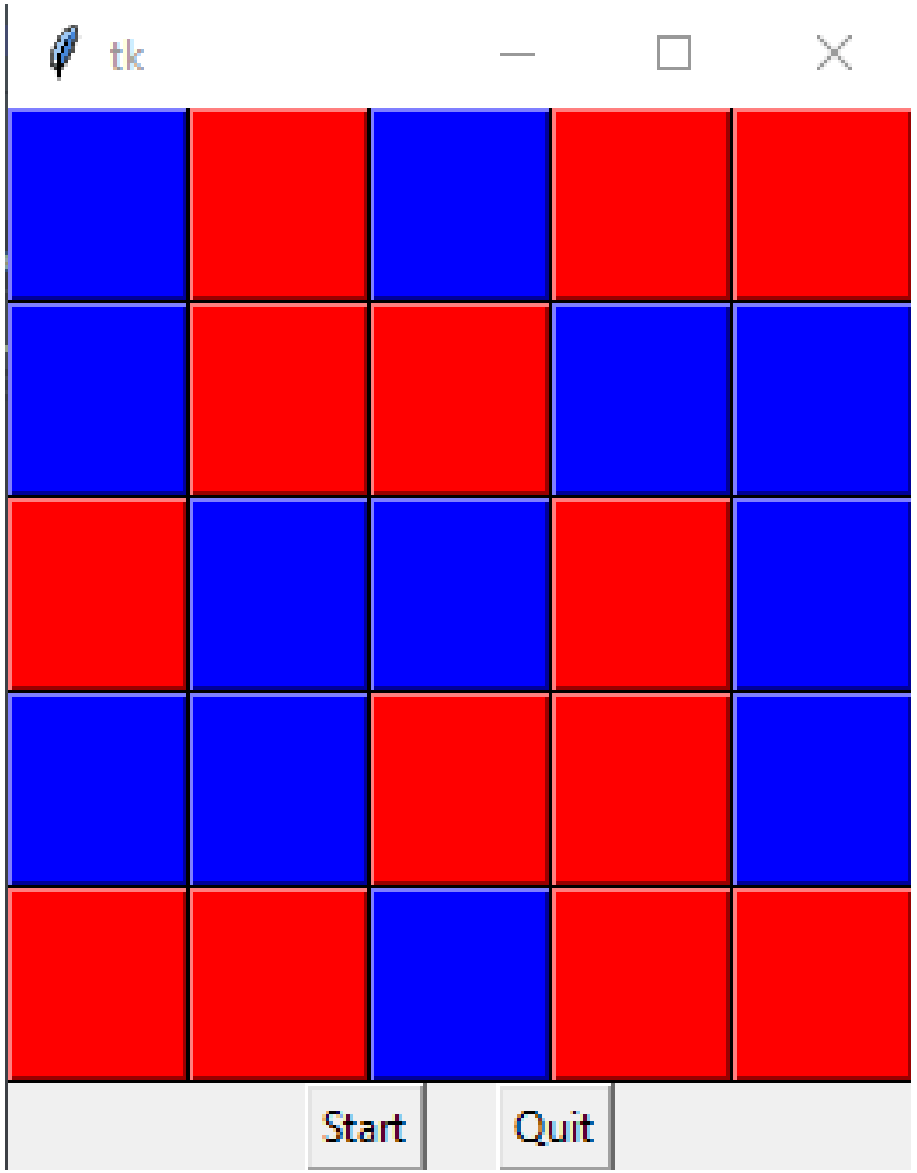


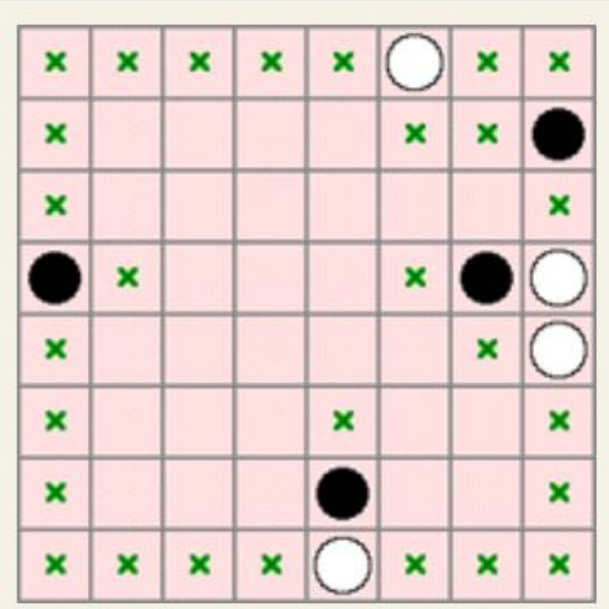
Agenda

1. Game Rules
2. Formulation of the Problem
3. Implementation Details
4. Approach
5. Algorithms
6. Results
7. References

How to play the game

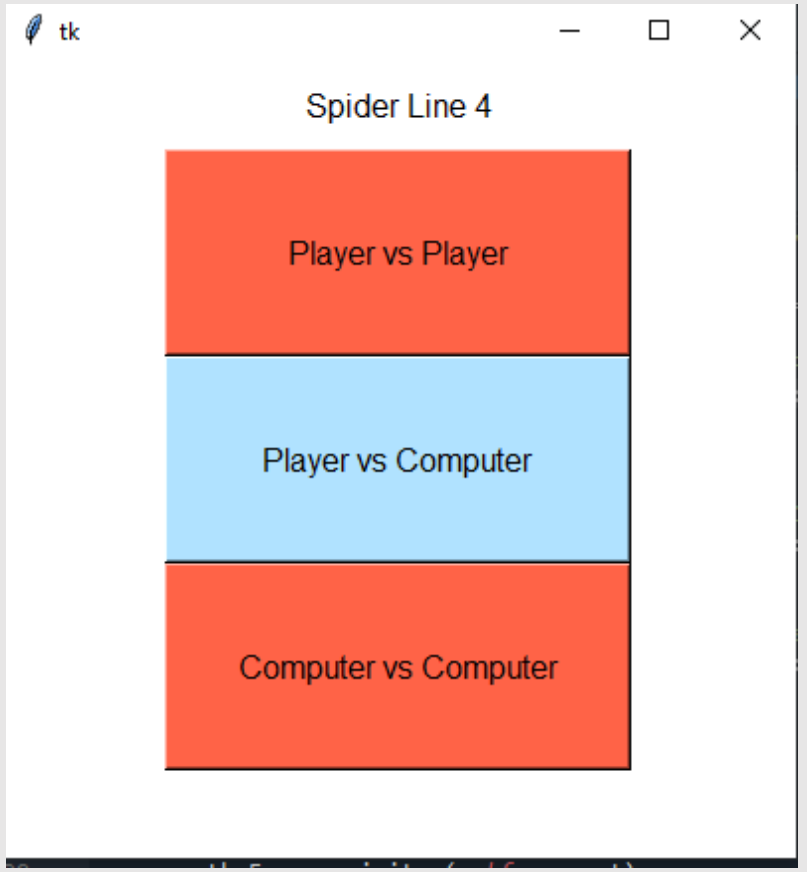
- Same winning idea as **Connect 4**

- More possibilities to play the pieces (2 dimensions instead of one)



Specification

- Different modes
- Different levels of difficulty
  - Different depths



Formulation of the Problem

- State Representation:
  - 5 X 5 Grid
  - General case B[N,M], filled with values
    0..2 # 0 represents empty square, 1 and 2 pieces from player 1 or 2.

- Initial State: Empty Board (all zeros)

- Objective Test: Line of 4 (vertical, horizontal or diagonal)

Formulation of the Problem

- Operators:

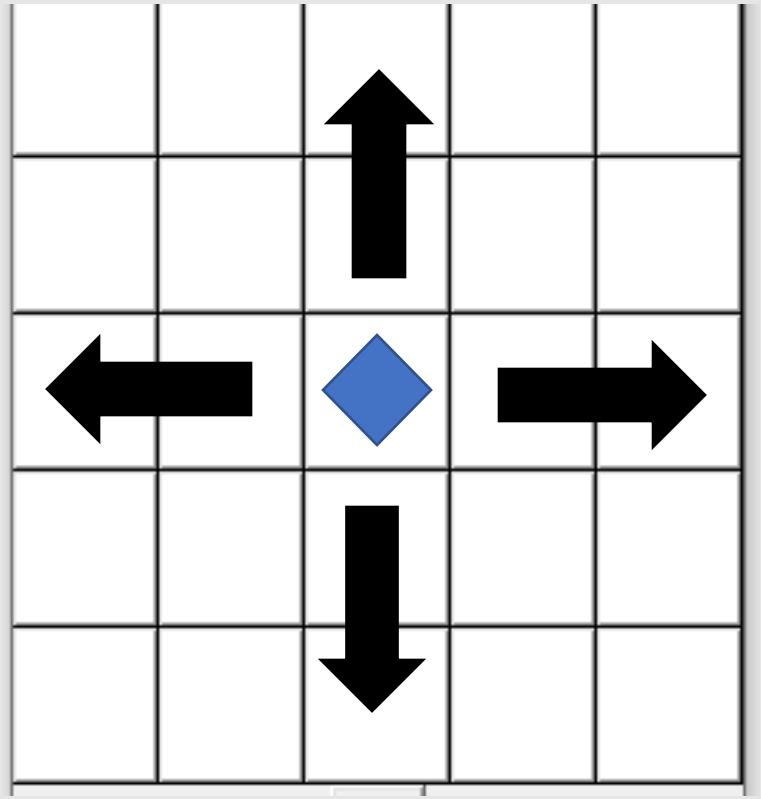
Name	PreConditions	Effects
Move(col,row,player)	**Board**[col,row]==0 **possible_pos** (col, row)	**Board**[col,row]= player

- Heuristics/Evaluation function:

Agent1: EvalF1 = nlines4(1) - nlines4(2)
Agent2: EvalF2 = 100* EvalF1 + nlines3(1) - nlines3(2)
Agent3: EvalF3 = 100* EvalF1 + central(1) - central(2)
Agent4: EvalF4 = 5* EvalF2 + EvalF3

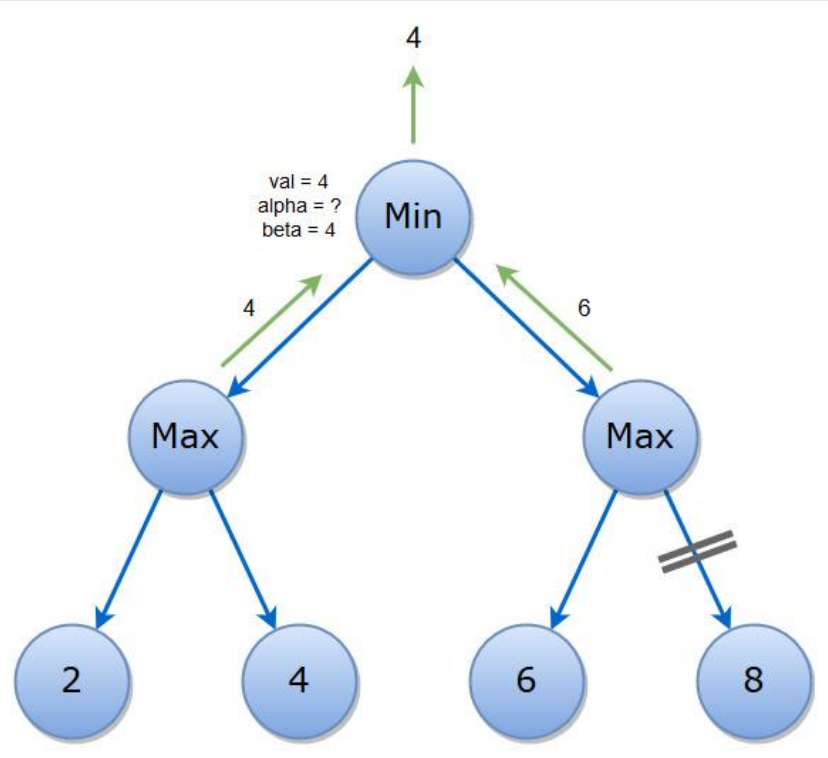
Defining the possible solutions

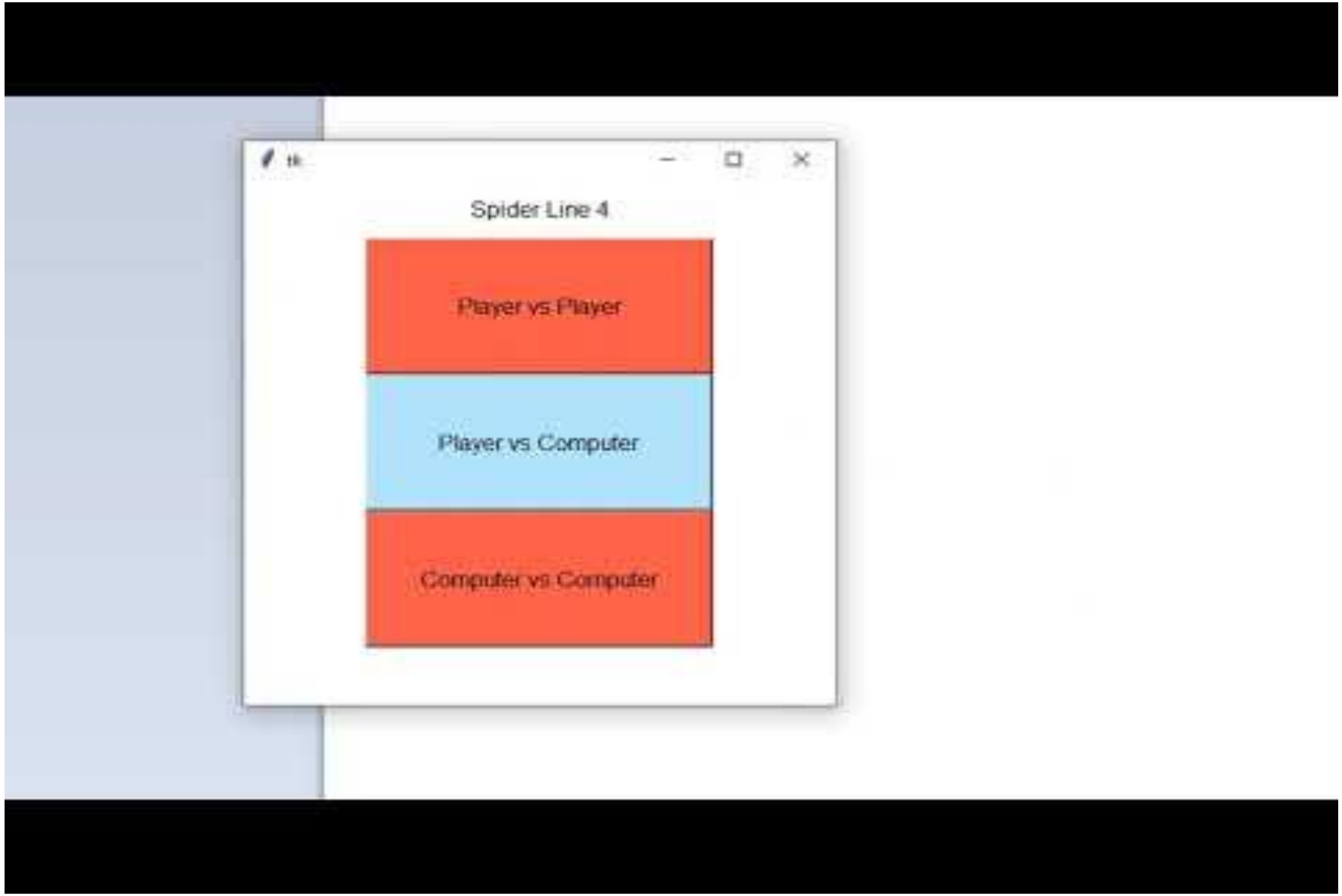
- Place defined by column and **row**
- Check if those cooardinates are available;
  - If so, edges are always acceptable
  - For middle moves positions on the left, right above and down need to be checked for other pieces



Computer mode

- 2 different playing modes using a Bot
- Search algorithm:
  - Minimax with alpha beta cuts




Spider Line 4
Player vs Player
Player vs Computer
Computer vs Computer

Results

- Depth 1
- Player 1 / Player 2 / Draw (AvgTime)

Depth = 1	Agent1	Agent2	Agent3	Agent4
Agent1	0/10/0 (0.1026)	0/10/0 (0.1110)	10/0/0 (0.0608)	10/0/0 (0.0694)
Agent2	0/10/0 (0.1285)	0/10/0 (0.1329)	10/0/0 (0.0700)	10/0/0 (0.0824)
Agent3	10/0/0 (0.0629)	10/0/0 (0.0744)	0/10/0 (0.1234)	0/10/0 (0.1288)
Agent4	10/0/0 (0.0844)	10/0/0 (0.0970)	10/0/0 (0.1417)	0/10/0 (0.0142)

Results

- Depth 4
- Player 1 / Player 2 / Draw (AvgTime)

Depth = 4	Agent1	Agent2	Agent3	Agent4
Agent1	0/10/0 (3.7446)	0/10/0 (5.7793)	0/0/10 (18.9145)	0/10/0 (18.0963)
Agent2	10/0/0 (7.4682)	0/10/0 (9.3959)	10/0/0 (10.7964)	0/0/10 (28.8591)
Agent3	10/0/0 (18.0854)	0/10/0 (23.4742)	0/10/0 (63.9549)	0/10/0 (65.6957)
Agent4	10/0/0 (40.9636)	10/0/0 (44.4729)	0/10/0 (71.5192)	0/10/0 (57.6458)

References

- https://brainking.com/en/GameRules?tp=16
- https://moodle.up.pt/pluginfile.php/200867/mod_resource/content/0/Exercises_AI3_AdversarialSearch_SolutionTopics.pdf
- https://www.geeksforgeeks.org/backtracking-introduction/

Questions ?