

Assignment 2: Adversarial Search

Submission: Wednesday March 29th

Groups of maximum 2 students

Prof. Fabio A. González

Intelligent Systems - 2017-I

Maestría en Ing. de Sistemas y Computación

1. (2.5) Three stones game

Solve the problems in the notebook in <https://github.com/fagonzalezo/is-2017-1/blob/master/games.ipynb>.

2. (2.5) Open Field Tic-Tac-Toe

The idea is to solve the last question in posted in the Last Byte column written by Dennis Shasha in Communications of the ACM, Vol. 60 No. 1, Page 112, January 2017.

- (a) Create a class for the Open Field Tic-Tac-Toe game.
- (b) Use Alpha-Beta search to explore the game tree.
- (c) Define an evaluation function and test it.
- (d) Put your solution in a Python notebook called `ofttt.ipynb`.

The assignment must be submitted as a compressed file containing both the `games.ipynb` and the `ofttt.ipynb` files, **only these files**, through the following [Dropbox file request](#), before midnight of the deadline date. The file must be named as `is-assign2-unalusername1-unalusername2.zip`, where `unalusername` is the user name assigned by the university (include the usernames of all the members of the group).



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Dennis Shasha

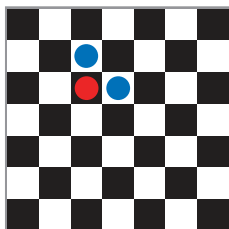
Upstart Puzzles

Open Field Tic-Tac-Toe

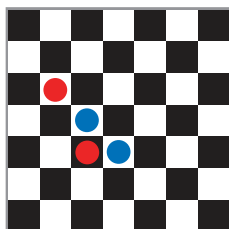
IN THE SPIRIT OF GOMOKU, two people play a version of the classic paper-and-pencil game tic-tac-toe but on an infinite checkerboard. In it, a player wins by getting four pieces in a row—vertically, horizontally, or diagonally.

Warm-up. Can the first player—blue—force a win in seven turns or less, where a turn consists of both blue and red placing pieces.

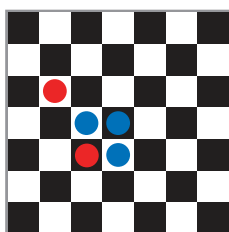
Solution to warm-up. The first player can force a win in five turns. Blue moves. No matter where red moves, blue can, in the second move, have two in a row.



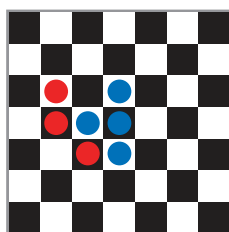
Red must now respond to prevent blue from having three in a row that is open on both ends. So R blocks, giving us something like



Blue can now force a two-by-two fork with

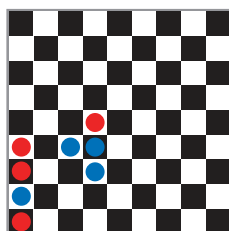


No matter where red goes, blue can force an open-ended vertical or horizontal line with three blues, as in

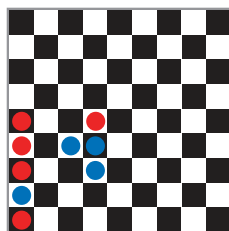


So... now that we know how it works, let us try it for some other problems.

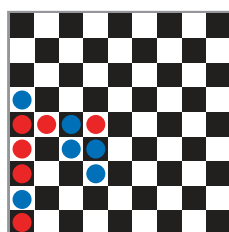
Suppose we have a board with a nine-by-nine grid with the following configuration, and red is about to take the next turn. Can either side force a win?



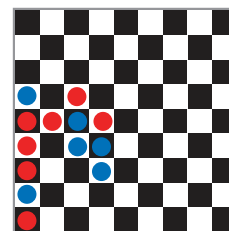
Solution. Yes, red can force a win. Red threatens...



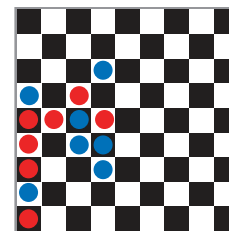
Blue then red then blue...



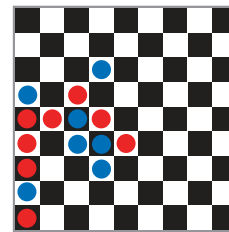
Red continues to threaten...



Blue responds...



Red now gets three in a row...



Upstart. Suppose the board is a six-by-six grid with a red exactly in every corner? Blue moves first. There is no limit on the number of turns. Can either side force a win?

All are invited to submit their solutions to upstartpuzzles@cacm.acm.org; solutions to upstarts and discussion will be posted at <http://cs.nyu.edu/cs/faculty/shasha/papers/cacmpuzzles.html>

Dennis Shasha (dennisshasha@yahoo.com) is a professor of computer science in the Computer Science Department of the Courant Institute at New York University, New York, as well as the chronicler of his good friend the omniheurist Dr. Ecco.

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