CSC4504 : Formal Languages & Applications

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http://www-public.telecom-sudparis.eu/~gibson/Teaching/CSC4504/

MinMaxAlphaBetaPruning

/~gibson/Teaching/CSC4504/Problem3-MinMaxAlphaBetaPruning.pdf

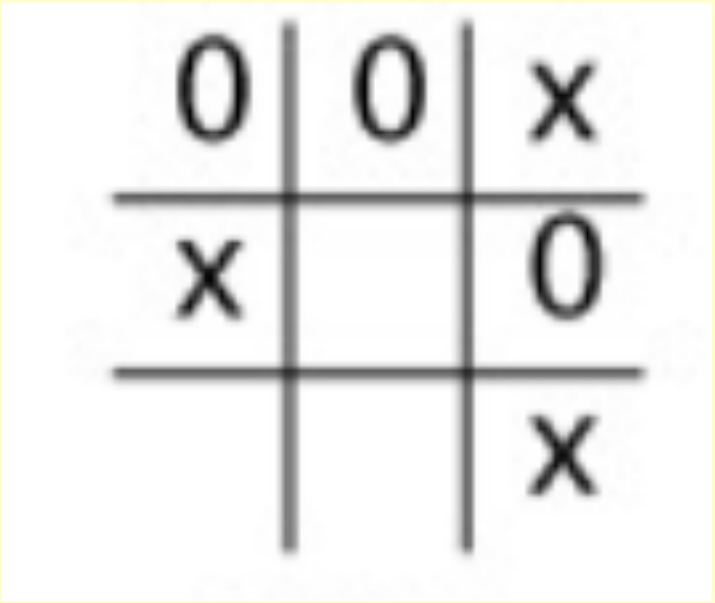
Alpha-beta pruning: a classic algorithm in AI (arising from minmax theorem)

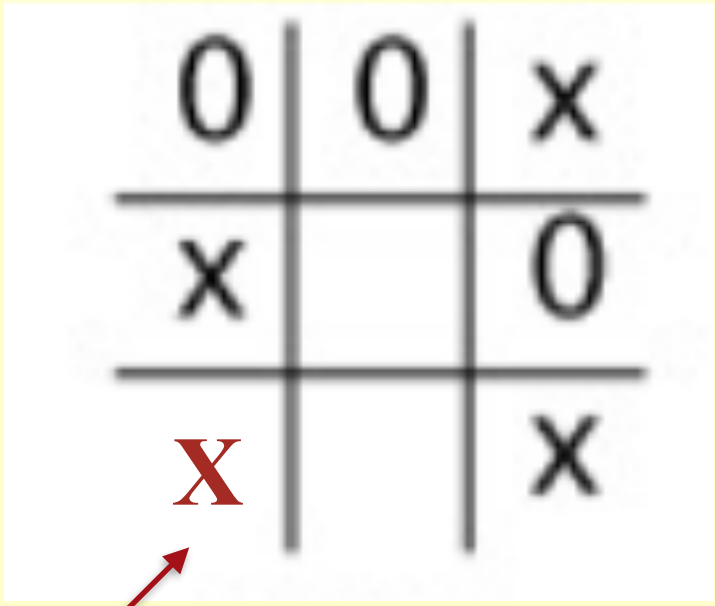
Von Neumann, John, and Oskar Morgenstern. "Theory of games and economic behavior." *Bull. Amer. Math. Soc* 51 (1945): 498-504.

Fuller, Samuel H., and John G. Gaschnig. "Analysis of the alpha-beta pruning algorithm." (1973).

Knuth, Donald E., and Ronald W. Moore. "An analysis of alpha-beta pruning." *Artificial intelligence* 6.4 (1976): 293-326.

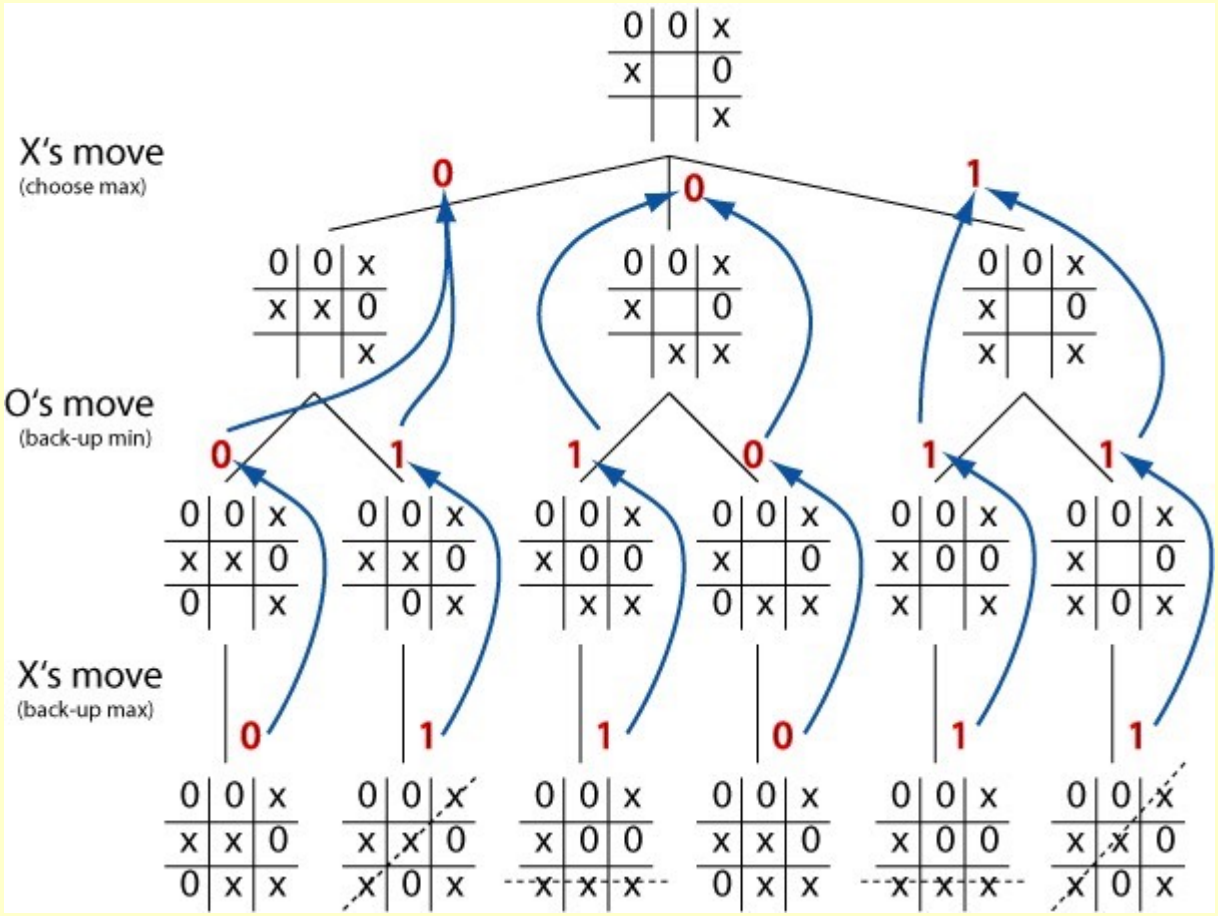
Noughts and Crosses





X to play - how could a machine/algorithm know that it should play the bottom-left in order to win?

KR-IST - Lecture 5a Game playing with Minimax and Pruning, *Chris Thornton*
http://www.sussex.ac.uk/Users/christ//crs/kr-ist/lec05a.html



Fitness Function
X win +1
Draw 0
O win -1

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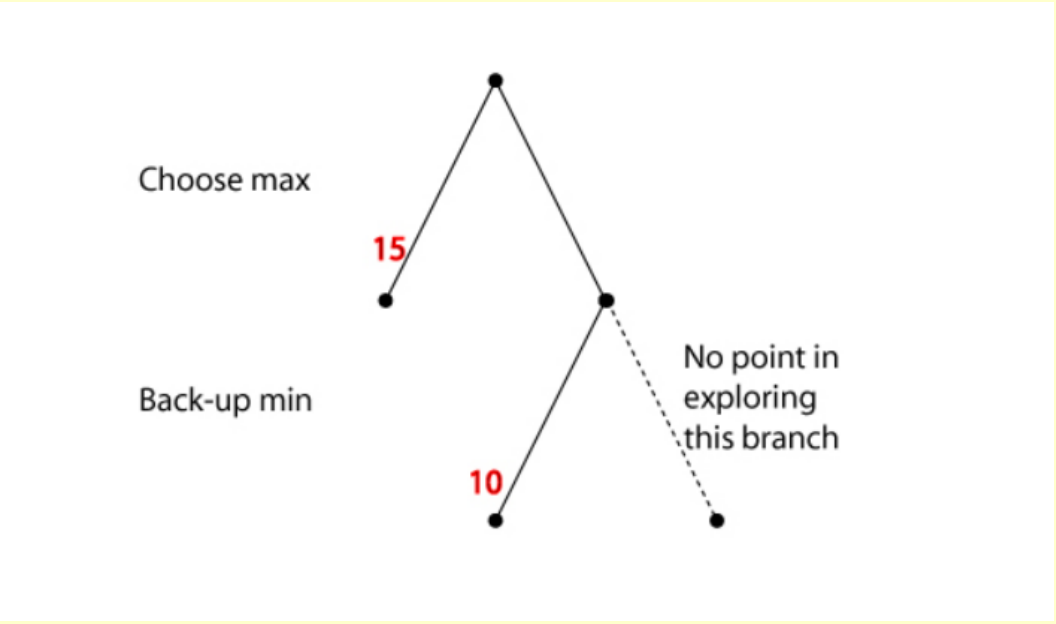
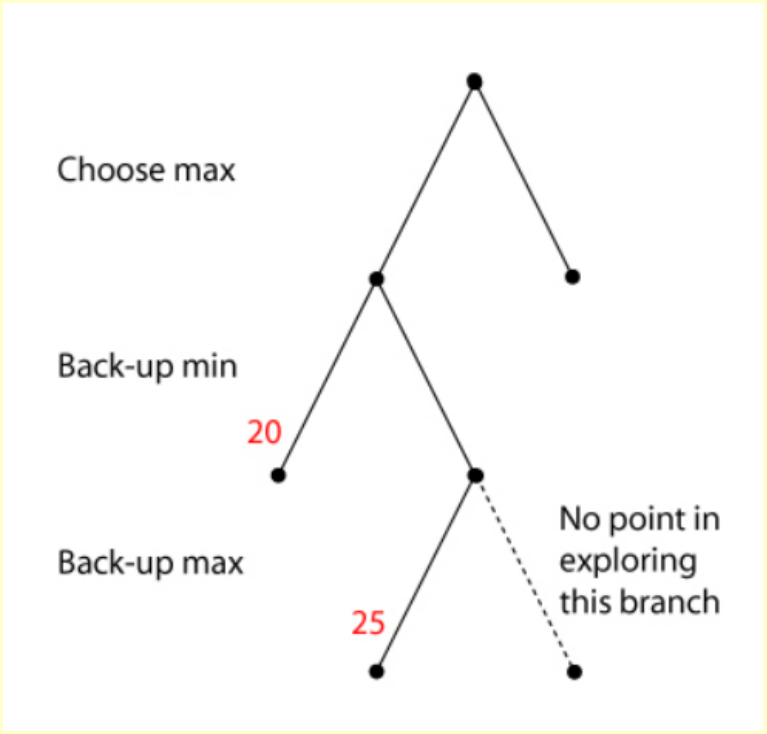
http://www.sussex.ac.uk/Users/christ//crs/kr-ist/lec05a.html

Alpha-beta pruning





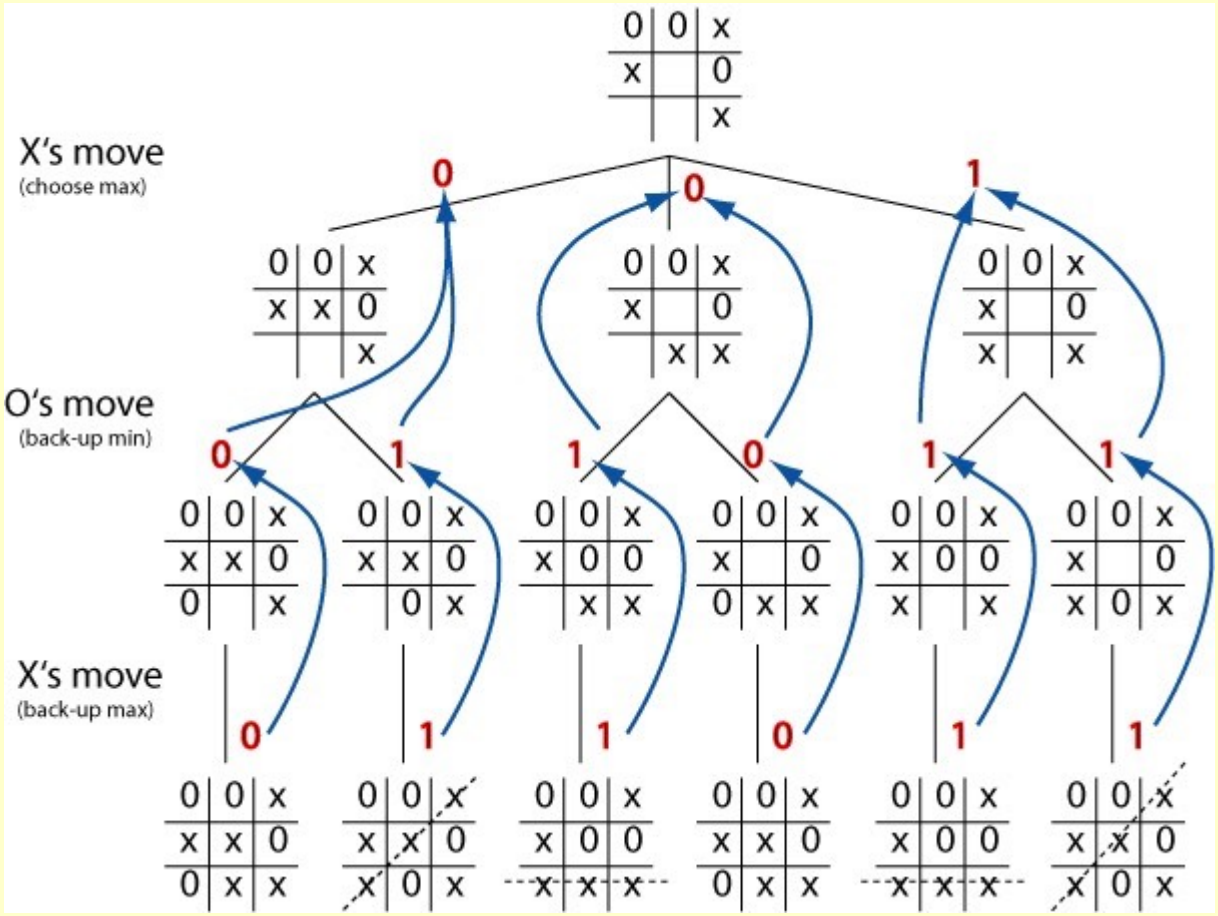
if (possible_min < current_max)
prune

Alpha-cutoff

if (possible_max > current_min)
prune

Beta-cutoff

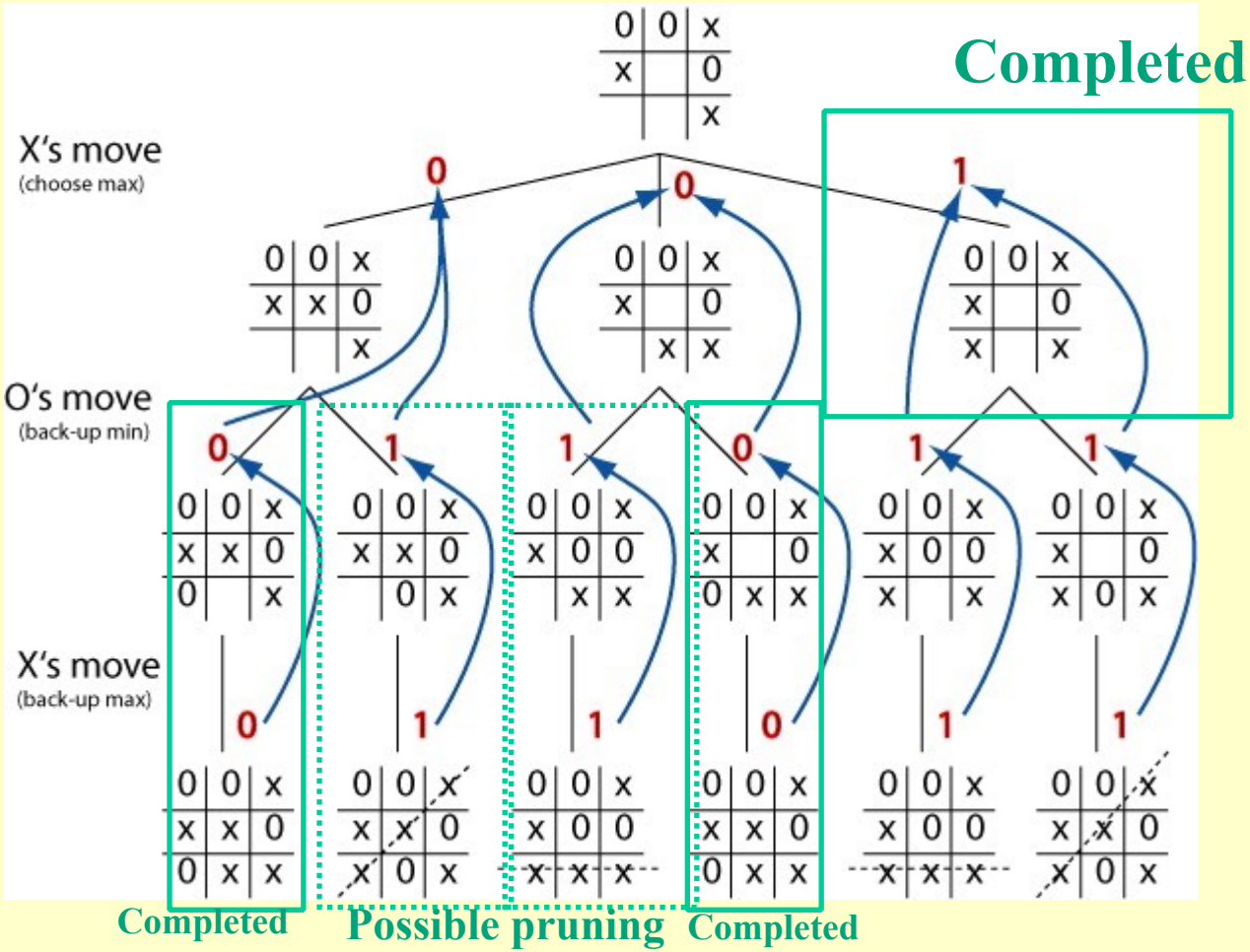
QUESTION: where *could* pruning be applied here?



X win +1
Draw 0
O win -1

QUESTION: where *could* pruning be applied here?

Depends on order of searching the branches



X win +1
Draw 0
O win -1

PBL : Minmax pruning for perfect XO player

Implement a *perfect* XO player:

1) Using min-max without pruning
2) Using min-max with alpha-beta pruning
3) Compare the performance of the players against each other

Can you verify/prove that your solution is *perfect?*

It would be best to 'design and implement' your own solution

You may also adapt a solution you find on the web, or re-use and test someone else's solution.

Question: what sort of fitness function/refinement would you need for playing chess, connect-4, etc …?