

*Advanced Programming - Leap 2014*

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# Developing An Othello AI

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# Artificial Intelligence

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- ❖ "the scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines" -AAAI
- ❖ Everywhere in society
- ❖ Even bigger role in the future

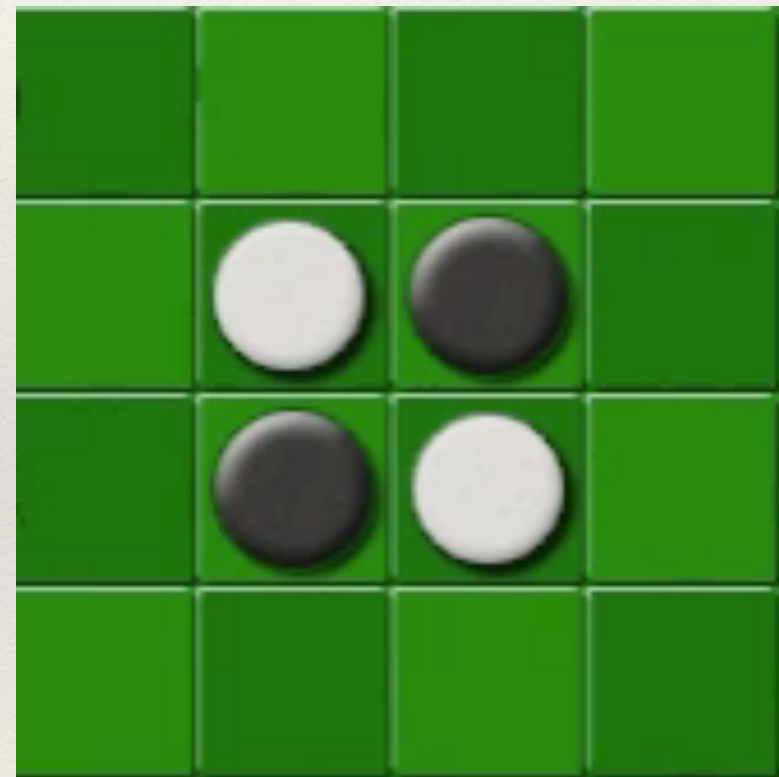


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# The Game : Othello

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- ❖ The goal of the game is to have a majority of discs of your color on the board
- ❖ A move consists of outflanking your opponent, and flipping the discs between.
- ❖ 8 by 8 board





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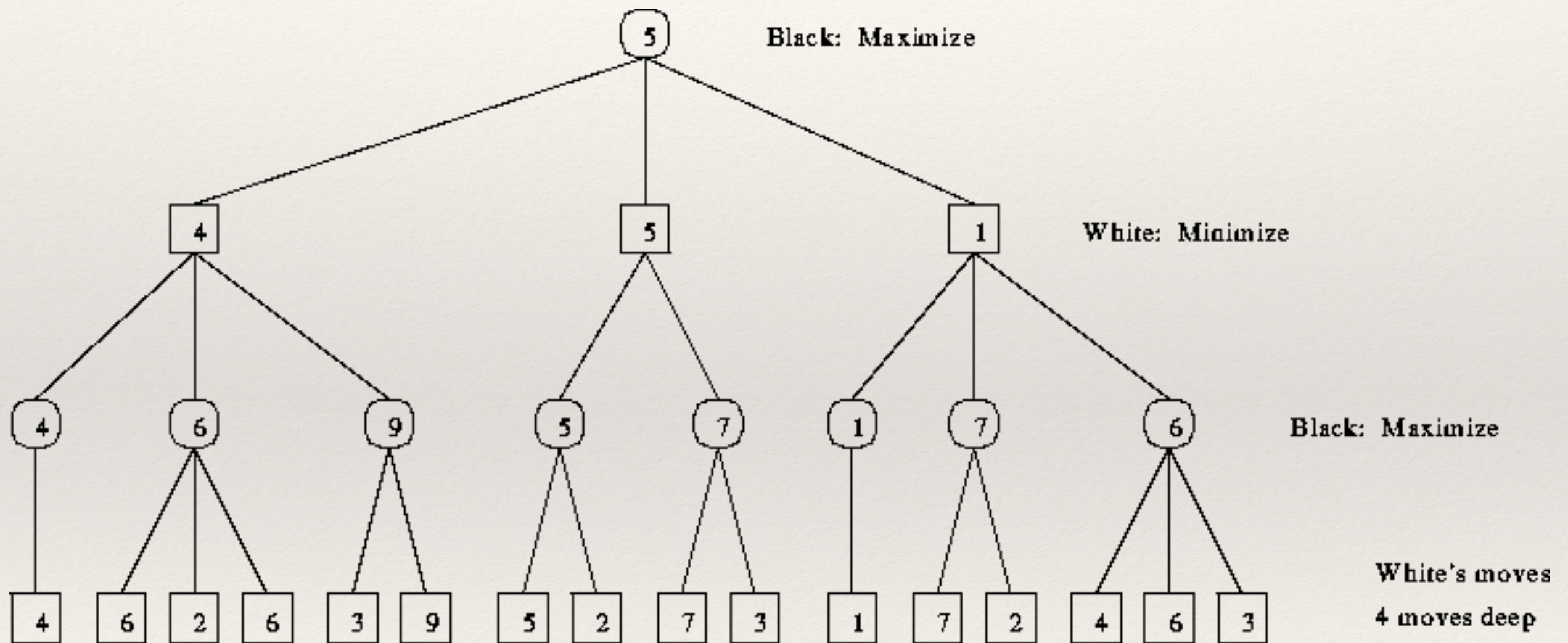
# Game Tree

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- ❖ Game tree is the hierarchy of possible moves / outcomes in the game
- ❖ Solved game / perfect play
- ❖ AI searches through the move tree, evaluating each result



# Game Tree





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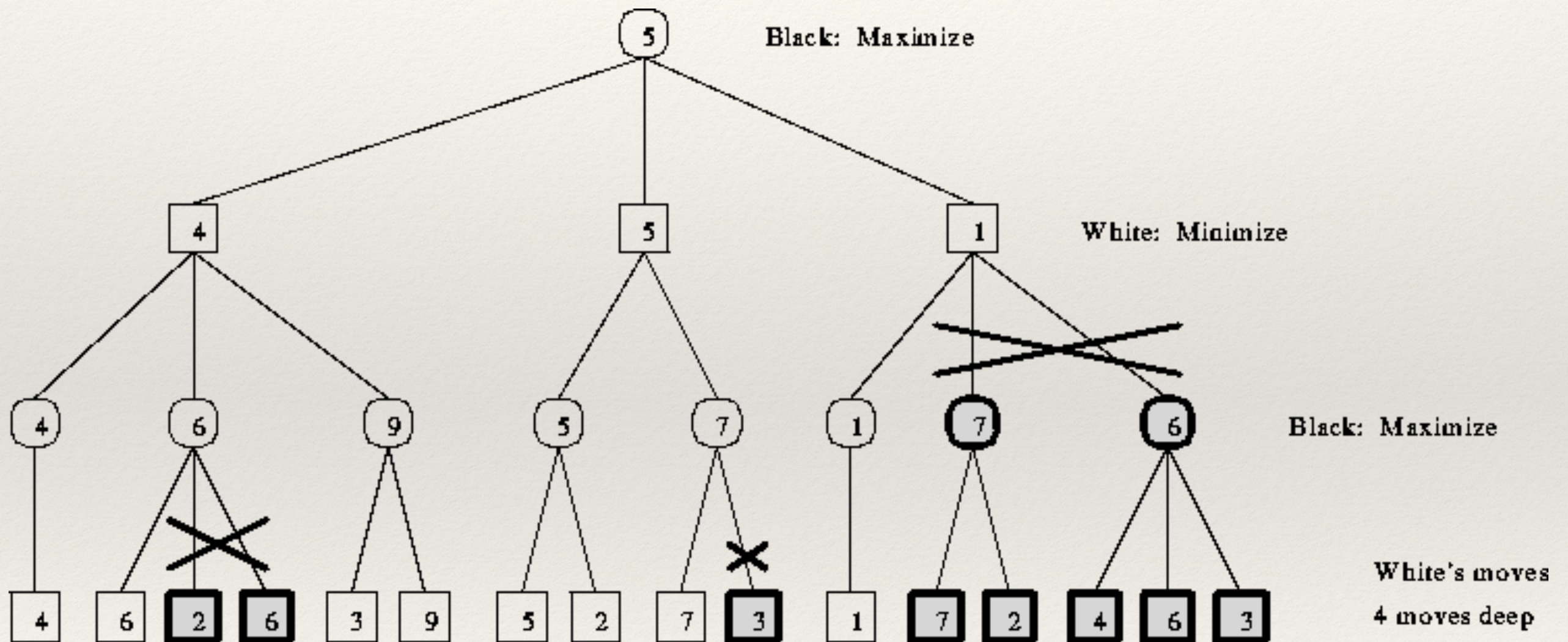
# Search Algorithm

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- ❖ Minimax
- ❖ Alpha-Beta Optimization



# Search Algorithm





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# Heuristic

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- ❖ Piece Difference
- ❖ Corner Occupancy
- ❖ Corner closeness
- ❖ Mobility
- ❖ Frontier discs
- ❖ Disc squares



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# Killer Moves

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- ❖ High priority on capturing corners



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# Endgame

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- ❖ A modified scoring method optimized towards quickly ending the game
- ❖ A simple piece count is evaluated when a “leaf” in the game tree is found



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# Performance

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- ❖ Able to beat all humans who faced it.
- ❖ Able to beat all bots it faced, except, DeepKwok, the number one bot out of Caltech Undergraduate in the last few years.



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# Demo

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❖ (mid-game test case)



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# To-Do

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- ❖ Transposition tables
- ❖ Opening book
- ❖ Dynamic heuristic
- ❖ Improved endgame
- ❖ Improved killer-moves
- ❖ Iterative deepening



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# References

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- ❖ <http://aitopics.org/topic/ai-overview>
- ❖ <http://www.site-creator.com/othello/othellorules.html>
- ❖ *Playing Othello with Artificial Intelligence*. Michael J. Korman. 11 December 2003
- ❖ *Game Playing & Adversarial Search*. Richard H. Lathrop.
- ❖ *An Analysis of Heuristics in Othello*. Vaishnavi Sannidhanam and Muthukaruppan Annamalai.