

272SM: Introduction to Artificial Intelligence

Homework Assignment: Games

Friday 21st April, 2023 - Thursday 25th May, 2023

Instructions

Report your answers to the following exercises and submit them at any time before the exam (latest 25th May 2023). Submitting homework solutions is highly recommended; Correct solutions will be counted as bonus points towards the final grade.

Exercise 1: Game transformation

Prove that with a positive linear transformation of leaf values (i.e. transforming a value x to $ax + b$ where $a > 0$), the choice of move remains unchanged in a game tree, even when there are chance nodes.

Exercise 2: Minimax tree pruning

In a full-depth minimax search of a tree with depth D and branching factor B , with alpha-beta pruning, what is the minimum number of leaves that must be explored to compute the best move?

Exercise 3: Implementation

Describe and implement:

- state descriptions
- move generators
- terminal tests
- utility functions
- evaluation functions

for **one** of the following games: tic-tac-toe, connect4, backgammon.

Implement a Monte-Carlo Search of the game tree and compare the performance wrt. other techniques (e.g. 2-limited-depth search). You can use the following projects as inspiration:

- <http://blog.gamesolver.org/solving-connect-four/01-introduction/> (connect4 implementation)
- <https://github.com/thomasahle/sunfish/blob/master/README.md> (competitive Chess engine in only 131 lines of Python code)