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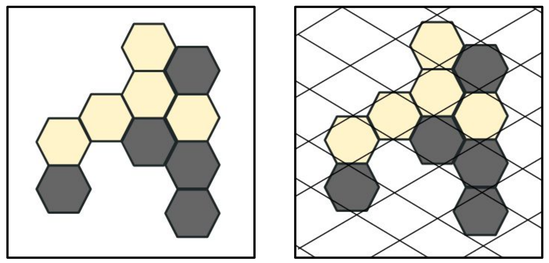
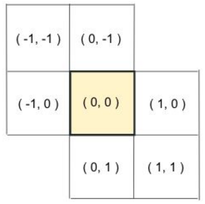
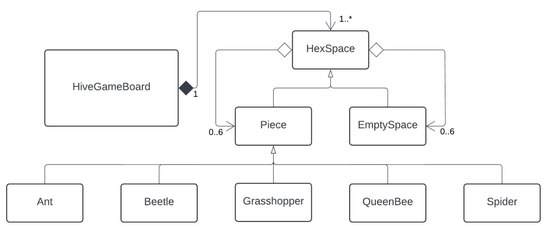
Hive Board Game AI

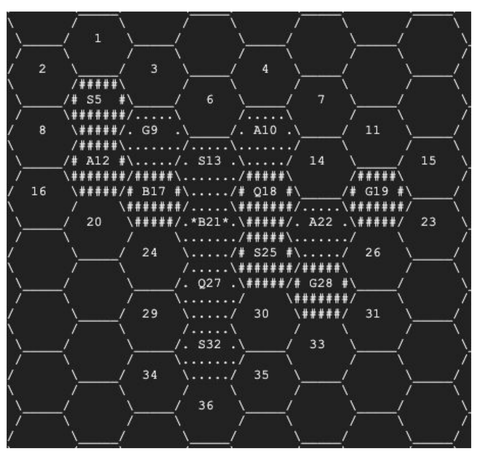
Developing an AI to play the board game, *Hive*, through the use of a minimax algorithm

Implementing the Game

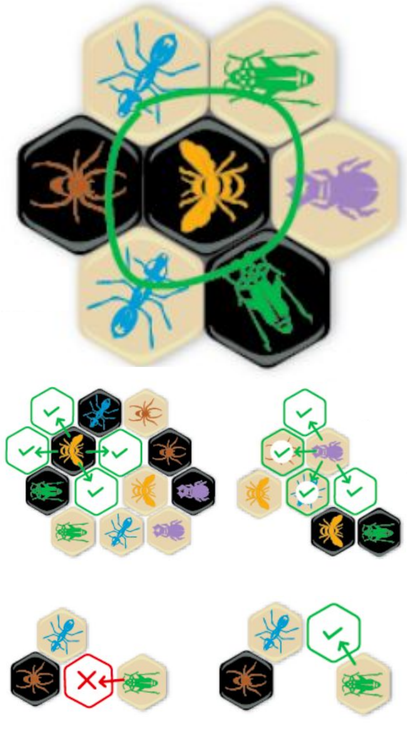








Game Background and Project Overview



Background

- Hive is a two player strategy-based board game
- Goal is to surround/capture your opponent's Queen Bee
- Similar to Chess

Overview

- Goal of this project was to create an AI that can play this game
- Implemented using Python
- Used a minimax algorithm with alpha-beta pruning and iterative deepening

Results and Conclusions

Results

- The AI is able to beat me! (sometimes)
- AI can see 2 turns (4 actions) in the future within a reasonable timeframe
  - Takes an average of 20 seconds
  - Can take up to 1-2 minutes when there are a large number of actions to process on a given turn
  - Reduces the total number of actions processed in a game from tens of millions to roughly 250,000
- Learned how to implement a minimax AI using alpha-beta pruning, iterative deepening, and a time limit
- Fairly happy with the results of this project :)

Source Code

- https://github.com/wdreames/hive_board_game_ai
- Includes instructions on how to install and play the game

Implementing the AI

Traversing Board States

- Need a way to check future actions
- Creating a deep copy of the board state was extremely inefficient
- To get successive states, actions would be logged as they are performed
- To get back to the original state, the AI would undo the logged actions

Speeding up Minimax

- Implemented alpha-beta pruning
- Sorted the generated action lists
- Recorded estimates of good/bad moves
- Implemented iterative deepening
- Applied a time limit
- Immediately played winning moves
- Looked one move further if there were 5 pieces around the opponent's Queen Bee

Creating an Evaluation Function

- This is what the AI uses to estimate what is a good or bad move
- Really good: Pieces around opponent's QB
- Good: Pieces that can move to QB
- Bad: Pieces that cannot move to QB
- Really bad: Pieces that cannot move at all

Minimax Example