

Final Review

CMPUT 355: Games, Puzzles, and Algorithms

Lecture Outline

1. Logistics & Recap
2. Algorithms
3. Games-specific properties
4. Data structures & implementations
5. Analytical results
6. Calculations

Final Exam Logistics

- **Final exam: Wed April 15** (next week!)
 - **CCIS L2-190** (this room)
 - **1:00pm** (*not* this time)
 - Format: like a **quiz**, but longer! (3-4 times as long as a quiz)
 - Cumulative: covers the **whole semester**
 - *Very slight* emphasis on post-quiz-5 (maybe one extra question)
- **Practice material:**
 - No practice final but finals from past offerings are available [here](#)
 - Warning: previous finals may include material we don't cover and miss material we did
 - Previous practice questions #1-5 will be very relevant to the final
 - **Practice questions #6** released yesterday; solutions posted yesterday

Algorithms

- Depth-first / breadth-first search
- Subgoals
- Transpositions
- A* search
- Minimax search
- Negamax search
- Alpha-Beta search
- Monte Carlo tree search
 - UCT

Game-specific Properties

- Go (Tromp-Taylor Rules)
 - Liberties, groups, etc.
- Hex
 - Rules of play
 - Full/semi-connections
 - Patterns
- Sliding tile puzzle
 - Inversions, taxicab distance
- Tic-tac-toe
- Nim

Data Structures & Implementations

- Computing Tromp-Taylor score
- Detecting blocks /liberties
- Board state for Go / Hex
- Union-Find Trees
 - `find_root` vs `merge_blocks`
 - union-rank optimization
- AND/OR strategies

Analytical results

- Proof trees
- Sliding tiles
 - Which positions are solvable
- Nim
 - Which positions are winning
 - Directly computing winning moves
- Hex
 - Strategy-stealing arguments, extra-stone arguments
 - $n \times n$ Hex is a win for Black

Calculations & Definitions

- Isomorphisms
 - Canonical forms
- Runtime estimates
- Mustplay regions
- Mixed and pure strategy Nash equilibrium
- Dominant strategies, expected utility, best response
- Perfect vs. imperfect recall, information sets
- Finite and infinitely repeated games (including Folk Theorem)
- Mechanism properties (direct, truthful, implementation)