Midterm Exam

- Time
  - In class (???am,60 mins) on May. 5 (Thu)
- Location
  - Online: Blackboard + Take home 12 hours (released at noon, due midnight)
- Format
  - Open-book
  - 20 multiple-choices (online) + 5 problems (take-home)
- Grade
  - 25% of the total grade

- F2018 midterm exam paper is available at:
  - Blackboard menu → Previous Exams → Fall 2018 Midterm Exam

Midterm Review

Disclaimer

- Topics covered in this review may not appear in the exam.
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Search

- Definitions
  - State space, successor function, start/goal states
  - Completeness, optimality
- Tree search
  - Uninformed Search
    - DFS, BFS, UCS
  - Informed Search
    - Heuristic, admissible heuristic
    - Greedy, A*
- Graph Search
  - A* with consistent heuristic

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Constraint Satisfaction Problems

- CSP
  - Find an assignment to a set of variables that satisfies a set of constraints
- Basic solution: backtracking search
- Speed-ups:
  - Filtering
    - Forward Checking, Arc Consistency
  - Ordering
    - Minimum Remaining Values, Least Constraining Value
  - Structure
    - Tree structured, Cutset conditioning
- Iterative min-conflicts (local search) is often effective in practice

Adversarial Search

optimal | un optimal

- Adversarial Search
  - Game tree, Minimax
- Resource Limits
  - Depth-limited search
  - Limiting branching factor
- Game Tree Pruning (alpha-beta pruning)
  - α: MAX's best option on path to root; prune if value of MIN ≤ α
  - β: MIN's best option on path to root; prune if value of MAX ≥ β
- Uncertain Outcomes
  - Expectimax

Propositional logic

- Representation
  - Syntax
    - Proposition symbols, their compositions using connectives
  - Semantics
    - Each model specifies true/false for each proposition symbol
    - Rules for evaluating truth with connectives
- Inference
  - Resolution (for Conjunctive Normal Form)
- Concepts
  - Validity, satisfiability, entailment, proof, soundness, completeness, etc.

Propositional logic - Horn logic

- Representation
  - $P1 \wedge P2 \wedge P3 \ldots \wedge Pn \rightarrow Q$
- Inference
  - Modus Ponens
  - Forward chaining
  - Backward chaining

First-order logic

- Syntax
  - Constant, predicate, function, variable, connective, quantifier (universal, existential), equality
- Semantics
  - A model contains: objects, relations, interpretation
- Inference
  - Propositionalization (universal/existential instantiation)
  - Unification
  - Forward/backward chaining
  - Resolution

Bayesian networks

- Syntax
  - DAG + CPTs
- Semantics
  - Global semantics
  - Conditional independence semantics, Markov blanket
  - D-separation

- Markov networks
  - Undirected graph + potentials
  - Semantics

Bayesian networks: Inference

- Exact inference
  - Inference by enumeration
  - Variable elimination
    - Interleave join (pointwise product) and elimination (summing out)
  - Efficient inference on polytrees

- Approximation inference
  - Prior Sampling
  - Rejection Sampling
  - Likelihood Weighting
  - Gibbs Sampling

Good Luck!