

## FINAL REVIEW

CMP 310

### Review

What did we learn this semester?

Search problems  
- methods for solving

Logic and probability  
- logic can generalize, but not good for representing uncertainty

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Learning  
- how to build agents that learn from experience

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### Review

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### What to do next?

- ◇ 411 - Knowledge Representation (Delgrande)
- ◇ 412/414 - Computer Vision (Furt, Drew, Li, Mori)
- ◇ 413 - Computational Linguistics (Sarkar, Popowich)
- ◇ 418 - Computational Cognitive Architecture (Hadley)
- ◇ 419 - Game Theory (Schulte)
- ◇ 419 - Machine Learning (Mori, Schulte, Sarkar)

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## Final Exam Format

Approximately 10 questions (with subparts)

- Same format as midterm, but longer
- Allowed cheat sheets, 2 single-sided pages (8.5" x 11" each)
- Bring a calculator

Two broad types:

- Apply algorithm A to problem P (denoted by A)
- Discuss tradeoffs / assumptions / relative merits of algorithms / problem formulations / models (short answer)

Exam is Sat. Dec. 6 12:00-15:00

- I will be away at a conference
- Prof. Richard Vaughan will proctor the exam

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## Constraint Satisfaction Problems

- ◇ Relationship to search problems
- ◇ Heuristics for solving
- ◇ Apply heuristics to problems (A)
- ◇ Algorithm for arc consistency ( $\neg$  A)

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## Intelligent Agents

- ◇ Definitions of AI
- ◇ Rationality
- ◇ Environment types
- ◇ Agent types

## Game Playing

- ◇ Minimax search (A)
- ◇  $\alpha$ - $\beta$  pruning (A)
- ◇ Apply these algorithms to game trees

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## Search

- ◇ Understand different problem types and strategies for solving each of them
- ◇ Naive search algorithms, tradeoffs and advantages/disadvantages of each (A)
- ◇ Heuristic search algorithms, why and how they work, advantages/disadvantages (A)
- ◇ Iterative improvement algorithms (hill climbing)

## Propositional Logic

- ◇ Models and entailment
- ◇ Inference algorithms
  - Enumeration
  - Forward/backward chaining ( $\neg$  A)
  - Resolution proof
- ◇ Horn clauses

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## First Order Logic

- ◇ Models and interpretations
- ◇ Write sentences in FOL (A)
- ◇ Actions
  - Situation calculus
  - Frame problem
  - Successor-state axioms

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## Temporal Probability Models

- ◇ Hidden Markov Models
- ◇ Filtering (A)
- ◇ Most likely explanation (Viterbi) (A)

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## Uncertainty

- ◇ Probabilities, conditional probabilities, random variables
- ◇ Normalization via  $\alpha$  constant
- ◇ Independence and conditional independence: reducing size of joint probability distribution
- ◇ Bayes' rule
- ◇ If you can do question 16.11 that's all you need in terms of algorithms

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## Rational Decisions

- ◇ Utilities
- ◇ Value of information (A, not really an algorithm, but a formula)
- ◇ Again, knowing how to solve problem 16.11 is enough

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## Bayesian Networks

- ◇ Constructing Bayesian Networks
- ◇ Joint distribution represented by a BN
- ◇ How to represent conditional distributions: Gaussian, Linear Gaussian, Sigmoid
- ◇ Methods for inference: enumeration, stochastic simulation ( $\neg$  A)

## Learning

- ◇ Generalizing from a set of examples (inductive learning)
- ◇ Issues: consistency vs. simplicity (Occham's razor)
- ◇ What is a decision tree?
  - How do we build one from a set of examples? (A)

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