Last update: December 11, 2012

Review for the Final Exam

CMSC 421: Final Review

CMSC 421: Final Review 1

Final Exam

- \diamondsuit According to the university exam schedule
 - the final exam is Monday, Dec 17, 10:30am-12:30pm
- \diamond Closed book, no electronic devices
- \diamond You may bring one sheet of notes; OK to write on both sides
- ♦ The "resources" page has the midterm and final exams for the last three times I taught the course
 - Both with and without answers
- \diamond To see all of them:
 - Go to the bottom of the page and click on "show all resources"

Summary of what we've covered

- \diamondsuit The midterm exam covered Chapters 1–6 and Python.
- \diamondsuit The final exam will include some of that, but it will emphasize the following:
 - Logical reasoning, Chapters 7–9
 - Planning, ≈ Chapter 10 and Section 11.2
 ♦ but use my lecture slides instead of the book
 - Uncertainty, Chapter 13
 - Bayesian networks, Chapter 14
 - Game theory, Section 17.5

Chapter 1: Introduction

- \diamond What AI is:
 - thinking versus acting
 - humanly versus rationally

Chapter 2: Intelligent Agents

- \diamondsuit Agents and environments
 - Rationality
 - PEAS (Performance measure, Environment, Actuators, Sensors)
 - Environment types
 - Agent types

 \diamondsuit Chapters 1 and 2 won't be on the exam

Chapter 3: Search

 \diamondsuit Problem types:

- deterministic, nondeterministic,
- fully observable, partially observable, non-observable
- example: vacuum world
- \diamond Tree-search algorithms
 - Breadth-first search
 - Uniform-cost search
 - Depth-first search
 - Depth-limited search
 - Iterative deepening
- \diamond tree search versus graph search

Chapter 3 (continued)

- \diamondsuit Heuristic search algorithms
 - Greedy search
 - A* on trees or on graphs with consistent heuristics
 - A* on graphs with inconsistent heuristics
- \diamondsuit Heuristic functions
 - admissibility, consistency, dominance
 - problem relaxation
- \diamondsuit Not on the exam:
 - IDA*
 - continuous spaces

Chapter 4: Beyond Classical Search

- \diamond Local search algorithms
 - Hill climbing
 - simulated annealing
- \diamondsuit Not on the exam:
 - beam search
 - genetic algorithms

Chapter 5: Adversarial Search

- \diamondsuit What type of game:
 - two-player, perfect information, zero sum
- \diamond Game trees, minimax values
- $\diamondsuit~$ Alpha-beta pruning
- \diamondsuit Depth-bounded search, static evaluation functions
- \diamond Node ordering
- \diamondsuit Nondeterministic game trees (e.g., backgammon)
 - expectiminimax

Chapter 6: Constraint Satisfaction

- \diamondsuit Variables, constraints, constraint graphs, backtracking search
- \diamond Variable selection heuristics:
 - MRV (minimum remaining values)
 - degree (most constraints on remaining variables)
- \diamond Value selection heuristic: least constraining value
- \diamond Pruning techniques
 - forward checking
 - arc consistency (constraint propagation)
- \diamondsuit Problem structure:
 - independent subproblems
 - tree-structured CSPs
 - cutset conditioning

Chapter 7: Logical agents

- \diamond Knowledge-based agents
- \diamond Wumpus world
- \diamondsuit Logic in general—models and entailment
- \diamond Propositional (Boolean) logic
- \diamondsuit Equivalence, validity, satisfiability
- \diamondsuit Inference rules and theorem proving
 - forward chaining
 - backward chaining
 - resolution

Chapter 8: First-Order Logic

- \diamondsuit Syntax:
 - symbols,
 - atomic sentences
 - quantifiers
 - logical connectives, equality
 - sentences
- \diamondsuit Semantics: interpretations, models, truth
- \diamond Substitutions
- \diamondsuit Wumpus world in FOL

Chapter 9: Inference in First-Order Logic

- \diamondsuit Reducing first-order inference to propositional inference
- \diamond Unification
- \diamondsuit Generalized Modus Ponens
- \diamondsuit Forward and backward chaining
- \diamond Resolution
- \diamond Not on the exam:
 - Logic programming

Classical Planning

- Related to Chapter 10, but based mainly on my lecture slides
- \diamondsuit Representation: states, operators, actions, plans, executability
 - Blocks-world examples
- \Diamond Planning problems and solutions
- \diamond Planning algorithms
 - Forward search
 - GraphPlan (dinner example)
- \diamondsuit Not on the exam: FastForward

Hierarchical Planning

- Related to Section 11.2, but based mainly on my lecture slides
- \diamondsuit Representation: tasks, methods
- \diamond the TFD algorithm
- \diamond air-travel example
- \diamondsuit State-variable representation
 - travel example
 - Pyhop
 - ♦ The exam won't have anything else about Python

Chapter 13: Uncertainty

- \diamond Basic probability theory
- \diamondsuit Notation for probability distributions over propositions
- \diamondsuit Conditional probability, chain rule
- \diamond Inference by enumeration
- \Diamond Independence and conditional independence
- \diamond Bayes' rule
- \diamondsuit Wumpus example

Chapter 14: Bayesian networks

- $\diamondsuit~$ Syntax what the networks look like
- \diamond Global semantics: joint distribution
- \diamondsuit Local semantics: conditional independence, Markov blanket
- \diamond constructing Bayesian networks
- \diamondsuit Inference by enumeration, variable elimination, irrelevant variables
- \diamond Stochastic simulation
 - Sampling from an empty network
 - Rejection sampling
- \diamond Not on the exam:
 - compact conditional distributions
 - Caching the probability tables
 - Likelihood weighting

Section 17.5: Game theory

- \diamond Prisoner's Dilemma
- \diamondsuit Strategies, strategy profiles, dominance, dominant strategy equilibria
- \diamond Pareto optimality
- \diamondsuit Mixed strategies, expected utility
- \diamondsuit Nash equilibria, von Neumann's maximin technique
- \diamondsuit Repeated games
 - Iterated Prisoner's Dilemma
 - Strategies: TFT, Grim, etc.
 - IPD with noise, DBS
- \diamond Not on the exam:
 - Rational preferences, common knowledge
 - *p*-beauty contest, rock-paper-scissors
 - World War I trench warfare