

CS494/594, Artificial Intelligence Fall 2009 Study Guide for Exam #2

(Exam #2 to be held in class on Thursday, Oct. 29)

NOTE: This is distributed as a study guide for Exam #2 to give you some idea of what to expect. These represent the style of questions you will be asked, or the type of information you should know, but they don't give specific questions. The questions you will be asked will come from this material. The exam is open book, open notes.

0. The exam covers Chapters 8-9, 11-14 (see course website for specific sections of chapters), and homeworks 3-5. You are expected to have read the assigned material in the text. Any basic knowledge you would obtain from a “tuned-in” reading of this material is “fair game” for the exam, for the topic areas listed below. While you won't be directly tested on material from the first part of the course, it is presumed that you remember the fundamentals of this prior material.

1. (Ch. 8-9) First order logic and inference

- Understand, and be able to use and define, concepts of first-order logic, including concepts of entailment, models, equivalence, validity, and satisfiability.
- Understand syntax and semantics of universal and existential quantification in first-order logic.
- Understand, and be able to use, standard logical equivalences (e.g., de Morgan's laws) and inference techniques (e.g., Generalized Modus Ponens, Resolution) for first-order logic.
- Understand concepts of unification, standardizing apart, and Skolemization in first-order logic.
- Understand, and be able to use, concepts of resolution, resolution theorem proving, conjunctive normal form, and forward and backward chaining, as applicable for first-order logic.
- Given a problem definition, be able to formulate it in first-order logic and use the developed knowledge base to prove conjectures using resolution.

2. (Ch. 11) Planning:

- Understand, and be able to use and define, concepts of planning, including the STRIPS planner, partial-order planning, and planning graphs.
- Understand how to represent problems using STRIPS, partial-order plans, and planning graphs.
- Understand how to generate plans using STRIPS, partial-order plans, and planning graphs.
- Know how to use planning graphs for heuristic estimation.

3. (Ch. 12) Real-world planning:

- Know what is meant by bounded indeterminacy and unbounded indeterminacy.
- Know the first 3 planning methods for handling indeterminacy (i.e., sensorless planning, conditional planning, execution monitoring and replanning), how to create plans using these methods, and what the characteristics are of these types of planning techniques.

4. (Ch. 13) Uncertainty:

- Know the basics of probability theory, including concepts of random variables, probability distributions, full joint probability distributions, conditional probability, axioms of probability, Bayes rule, and related concepts.
- Know how to perform inference using full joint probability distributions.
- Know how to apply the above solve probabilistic reasoning problems.

5. (Ch. 14) Introduction to Bayesian Networks:

- Know the syntax and semantics of Bayesian networks.
- Understand how to create a Bayesian network for a problem.
- Know how to use a Bayesian network to calculate the probability of an event represented in the network.

Examples of the style of problems to be asked:

The style of this exam will be the same as the first exam. That is, everyone should be able to work “mechanical” problems, which are of the style of:

- “Represent the following sentences in first-order logic.”
- “Convert the following first-order logic expression into conjunctive normal form.”
- “Use resolution to prove a premise in first-order logic expressions.”
- “Give the STRIPS definitions for a stated problem.”
- “Given STRIPS definitions, generate a plan to achieve a stated goal.”
- “Generate a partial ordered plan to achieve a stated goal for a stated problem.”
- “Given a plan, identify it as an unconditional, conditional, or execution monitoring plan.”
- “Give a sensorless plan to solve a given problem.”
- “Given a set of probabilistic data, or a statement of a probabilistic problem, use the rules of probability to compute a particular probability”.
- “Given a Bayesian network, calculate certain probabilities.”
- “Given a problem statement, create a Bayesian network that represents the problem.”

For undergraduates, the questions will all be of this objective, mechanical style of problem-solving.

For graduate students, I expect to see more of an ability to reason about the material at a higher level, not just a mechanical style of problem solving, similar to some of the homework problems. But, yes, I am still aware that you have much more time to work homework questions than you do exam questions, so the difficulty will be scaled accordingly. Graduate students should also be prepared to answer any novel application of the material listed above.