420-500: Final Exam Review

- Final exam: 11/18 (Tue) 12:45pm-2:00pm, in HRBB 113.

- Final exam material: slide04 (page 46 and beyond), slide05 (all), slide06 (all).

- This is a closed book exam, however, see the next item.

- You may bring 1 sheet of notes (US letter), however small the fonts may be (obviously it should be legible to you). You may use both sides.

- You may bring a calculator, although you may not need it at all.

Key Points: 1

- First-order logic

- Prenex normal form, skolemization

- Substitution

- Unifiers

- Resolution: two-pointer method, efficiency

- Question answering

Key Points: 2

- Uncertainty

- Decision theory example: how prob theory and decision theory are combined

- Probability basics: terminology, notations.

- Joint probability distribution: concept

- Conditional probability: definition, various ways of representing conditional prob.

- Axioms of probability: basic axioms, and using them to prove simple equalities.

- Bayes rule: definition and application.

Key Points: 3

- Why and when is Bayesian analysis useful?
  - Disease example
  - Vision example

- How to calculate priors from conditional distributions?

- How is subjective belief utilized in Bayesian analysis?

- What is the role of priors in Bayesian analysis?

Key Points: 4

- How is subjective belief utilized in Bayesian analysis?

- Bayesian updating: why does that make probabilistic inference efficient when multiple evidence comes in?

- Belief network: definition, semantics, extracting probabilities of certain conjunction of events.

Key Points: 5

- Constructing a belief network: what is the procedure? why does node ordering matter? how to order the nodes?

- Inference in belief networks: what are the kinds of inference? what is the general method? (causal, evidential, etc.)

Key Points: 6

- Types of learning

- Inductive learning (concept)

- Decision tree learning:
  - What is the embodied principle (or bias)?
  - How to choose the best attribute? Given a set of examples, choose the best attribute to test first.
  - What are the issues? noise, overfitting, etc.
  - Relationship between probability, degree of surprise, degree of uncertainty, entropy, and information (gain).
  - Know how to calculate entropy and info gain.

Key Points: 7

- Neural networks: basics

- The central nervous system: how it differs from conventional computers (no need to memorize numbers, anatomical names).

- Basic mechanism of synaptic information transfer (no need to memorize chemicals etc.)

- Types of neural networks: two ways of classifying, by feedback and by topology.

- Perceptrons: basic idea, and the geometric interpretation. What is the limitation? How to train?

- Backprop: how does it overcome perceptrons, learning algorithm (basic idea).

Key Points: 8

- Unsupervised learning in general

  – relationship between redundancy, structure/organization, channel capacity vs. information content

  – what can kind of things can unsupervised learning do?

- SOM: basic learning rule

- SOM: error measures

- SOM applications

Key Points: 9

- Recurrent networks and their uses

- GA and Neuroevolution