

## 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.

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## 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.

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## Key Points: 1

- First-order logic
- Prenex normal form, skolemization
- Substitution
- Unifiers
- Resolution: two-pointer method, efficiency
- Question answering

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## 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?

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## 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.

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## 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.

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## 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.)

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## 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).

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## 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