Logistics

- In testing center Nov 14 -- Nov 16. Available from when the testing center opens until it closes each day.
- One 8.5"x11" sheet of notes allowed
- Closed book
- Similar format to previous exams
- 3 hour timed exam
- Closed book

Bayesian Networks

- Bayes Rule
- Distributions
  - Joint
  - Marginal
  - Conditional
- Chain rule
  - Product of conditional distributions
- Conditional independence
- Graph structure and interpretation
  - Syntax
  - Semantics
  - Conditional probability tables
  - Obtaining joint, marginal, and conditional distributions from the graph and tables
- Canonical networks
  - Noisy AND
  - Noisy OR
  - Markov process: first order, second order, etc.
  - Naive Bayes
  - Partially observable Markov process

Bayes Filter

- Assumptions of Bayes filter
  - Transition probability: $p(x_t \mid x_{t-1})$
  - Observation probability: $p(z_t \mid x_t)$
  - Equations for $bel(x_t)$ and $\overline{bel}(x_t)$
  - Conditional independence assumptions
- Grid filter
  - Modeling assumptions
  - Representation
- Relation to the Kalman filter

Kalman Filter

- Gaussians
  - Scalar and vector forms
  - Priors
  - Likelihoods
  - Posteriors
- System of transition model
  - $p(x_t \mid x_{t-1}) \sim N(Fx_{t-1}, \Sigma_x)$
  - $x_t = Fx_{t-1} + \eta_{t-1}$
  - $\eta_t \sim N(0, \Sigma_x)$
- Observation model
  - $p(z_t \mid x_t) \sim N(Hx_t, \Sigma_z)$
  - $z_t = Hx_t + \nu_t$
  - $\nu_t \sim N(0, \Sigma_z)$
- Kalman filter equations: must be able to interpret and manipulate
  - μ_t
  - Σ_t
  - K_t
  - Balance between transition and observation noise
- Limitations

Games

- Payoff matrix
- Consequences, states, actions, goals, preferences, and utilities: representation for two-player games.
- Solution Concepts
  - Strategic dominance
  - Minimax
  - Nash equilibria
  - Pareto optimal
- Turn-taking games
  - Maximin
  - alpha-beta pruning
  - Evaluation functions

Sample Problems

- Problems on the Bayesian nets homework are typical of problems that have appeared on previous exams.
- Problems from the second Kalman filter homework were drawn from previous exams.
- The problem from the Games homework was drawn from a previous exam. Related questions include finding the set of Pareto optimal solutions for the game, finding Nash equilbria for two-player and two-action games, and determining whether there are any strategically dominant solutions. Alpha-beta pruning problems are also fair game.
- Bayes filter problems are possible that are similar to the problems from the second Kalman filter homework. I might give some mathematical condition that intuitively should make the problem of applying the Bayes filter

more easy, and then ask you to show how that simplifying condition makes the equations easier to interpret. Applying the equations for simple models would also be fair game.