1 Overview

- 2 questions with approximately 3 parts, 15 points each
- 3 questions with approximately 6 parts, 30 points each (choose 2)
- the exam will be close everything, will take place in class, and be 75 minutes long
- should be generally familiar with the material and key insights from the course
- everything, including readings, notes, lectures, problem sets, and labs, is fair game

2 Basic Probability

- pgs 14-18 in *Probabilistic Robotics*
- should understand: conditioning, marginalization, Bayes rule, expectation, variance

3 Bayes Filters

- know how recursive Bayesian filtering works
- know what the Markov property is
- know the motion model, measurement model, and what they are used for
- know $p(x_t \mid h_t) \propto p(z_t \mid x_t) \int p(x_t \mid x_{t-1}, u_t)p(x_{t-1} \mid h_t)dx_{t-1}$

4 Particle Filters

- know what Monte Carlo sampling is
- know the particle filtering algorithm
- know (normalized) importance sampling
- know how to resample
- know how the particle filter is related to importance sampling
5 Directed Graphical Models

• know the 3 rules for determining dependence / independence of variables

6 Undirected Graphical Models

• know the similarities and differences between directed and undirected graphical models
• know what a Markov blanket is
• know how to moralize a graph
• know what MRFs, Gibbs Fields, and potential functions are

7 Online Learning

• what is online learning? Why would I want to use it?
• know how to define regret
• know what a no regret algorithm is
• know the generalized weighted majority algorithm
• know how “Follow the Leader” (FTL) algorithms operate

8 Online Convex Programming

• know what a convex set is
• know what a convex loss is
• know what a subgradient is
• know the algorithm for projected subgradient descent

9 Gaussian Properties

• moment parameters
• natural parameters
• know how to switch between parameterizations
• know the equations for conditioning a Gaussian in moment parameters
• be sure to read the notes on Gauss Markov models
• know the graph interpretation of the precision
• know the updates for Bayesian linear prediction (the updates to the natural parameters), be familiar with the derivation we covered in class
• know how to predict with the learned model

10 Kalman Filtering

• know the Kalman Filtering equations (be able to write them down from memory)
• know how the Kalman filtering equations are related to Gaussian properties
• know what the Kalman gain is
• know what the innovation is
• know how the extended Kalman filter (EKF) works
• know how the EKF can be used for online nonlinear regression