**CS470 Final Review Sheet**

**Fall 2016**

**Content covered prior to the midterm:**

**Intelligent agents**

* **Rationality**
* **Types of agents (reflex vs. goal-based vs. utility-based vs. learning)**

**Potential Fields**

* **Basic formulation**
* **Combining potential fields**
* **Understand the pros and cons**

**Search**

* **Understand various search algorithms and their properties**
* **BFS, DFS, Uniform-cost search, iterative deepening, A\***
* **Gradient ascent/descent (basic idea)**
* **Simulated annealing (basic idea)**

**RRT**

**Games**

* **Minimax/maximin values and strategies**
* **Nash equilibria**
* **Relationship between Nash equilibria and minimax/maximin**
* **Minimax search**
* **Alpha-beta pruning**
* **Heuristic evaluation functions**
* **Forward pruning (basic idea — pros and cons)**
* **Lookup tables**

**Uncertainty**

* **Probability spaces**
* **Probability axioms**
* **Random variables**
* **Joint distributions**
* **Independence**
* **Conditional distributions**
* **Bayes rule**
* **Chain rule**
* **Conditional independence**
* **Naive Bayes**
* **Bayesian networks**

**Content covered after the midterm**

**Hidden Markov Models (HMM) — no need to memorize equations**

* **State transition models**
* **Sensor models (emission probabilities)**
* **The Markov assumption (1st order, 2nd order, etc.)**
  + Based on the last state (1st order), the last 2 states (if 2nd order), etc
* **Have an understanding of the basic idea.  When would you use a HMM?** 
  + Observations correlated with the state, but I don’t see the state itself.
* **Basic notion of how to predict the current state based on a series of observations (filtering)**
  + Main objective is to ask, “What is the current state given all my past events?”
* **Basic notion of how to predict past states based on a series of observations (smoothing)**
  + I have seen all these observations, then I look in the past.
* **Understand the Viterbi Algorithm.  What is it computing and how does it work?**

**Decision Theory**

* **Utility Theory + Probability Theory**
* **Utility theory** 
  + **Lotteries** - Because there is a max and min value for some p, then there will be some value that will match a middle preference
    - (Pizza (max) > Salad (middle) > Poked (min))
  + **utility functions, the utility of money, human judgment**
* **Risk aversion**
* **Expect utility maximization** 
  + **What do you need to know to use it?**
    - Utilities - Probabilities
    - The sum of p(o)\* U(o)
      * Probability of the outcome times the Utility of the outcomes
  + **Why might it not work?**
  + **Satisficing**
    - “It’s a good decision. Getting the best isn’t probable.”

Sequential Decision Making

* Markov Decision Processes (MDPs)
  + Basic definition (components)
  + When would you use them?
* Value iteration
  + How does it work?
    - Trying to find the values and then iterate on those
  + What do you need to know to make it work?
* Policy iteration
  + How does it work (basic idea)?
  + Policy Strategy - For every state, I have strategy on what to do
  + 1. I initialize my policy to something
  + 2. Policy Evaluation - compute new utilities for each state, given the policy
  + 3. Policy Improvement - Choose a new strategy given the new utilities I gain
  + What do you need to know to make it work?
  + Current Utilities
* Reinforcement learning
  + Basic idea
* Epsilon-greedy exploration