CSCI 446 – ARTIFICIAL INTELLIGENCE
EXAM 2 STUDY OUTLINE

Probability
I. Random Variables
II. Joint and Marginal Distributions
III. Conditional Distributions
IV. "Rules"
       A. Product Rule
       B. Chain Rule
       C. Bayes' Rule
V. Inference
VI. Independence
       A. Absolute
       B. Conditional

Bayes Nets
I. Representation
       A. Graphical Model Notation
       B. Semantics
              1. Conditional Probability Tables
II. Independence
       A. Bayes Net Independence Assumption
       B. D-Separation
              1. Causal Chains
              2. Common Cause
              3. Common Effect
III. Inference
       A. Enumeration
       B. Variable Elimination
              1. Factors
                     a. Selected Joint
                     b. Single Conditional
                     c. Family of Conditionals
                     d. Specified Family
              2. Variable Ordering
       C. Sampling
              1. Prior Sampling
              2. Rejection Sampling
              3. Likelihood Weighting
              4. Gibbs Sampling

Decision Networks and the Value of Perfect Information
I. Decision Networks
       A. Chance Nodes (Bayes Nets)
       B. Action Nodes
       C. Utility Nodes

II. Value of Information
    A. Maximum Expected Utility (MEU)
        1. With and without evidence
    B. Value of Obtaining Information
    C. Properties
        1. Non-negative
        2. Non-additive
        3. Order-independent
III. POMDPs – Partially Observable Markov Decision Processes
    A. Belief States

Hidden Markov Models
I. Exact Filtering
    A. Base Cases
        1. Observation
        2. Passage of Time
    B. Forward Algorithm
II. Particle Filtering
    A. Process
        1. Generate Particles
        2. Elapse Time (Simulate Change)
        3. "Observe" Evidence – Weight according to probability
        4. Resample
    B. Dynamic Bayes Networks
    C. Most Likely Explanation (MLE)

Naïve Bayes
I. Classification
    A. Model-Based Classification
II. Training and Testing
    A. Generalization and Overfitting
    B. Parameter Estimation
    C. Smoothing
    D. Unseen Events
    E. Tuning
    F. Features