Review

Problem-solving

Solving problems by search, methodology, examples, review of BFS, DFS

Representing problems, heuristics, A*, f(n) = g(n) + h(n), how A* works, admissible heuristics, dominates

CSP, variables, domains, constraints, binary constraints, global constraints,

CSP, consistency algorithms, arc consistency

CSP, backtracking search, arc consistency prior to search, maintaining arc consistency during the search

CSP, local search: neighbourhoods, global and local minima, cost function, improvements, hard and soft constraints, starting points

Assignment #1:

- **Q1: A* search**
- **Q2: CSPs and backtracking search**
- **Q3: local search**

Knowledge, reasoning, and planning

Planning with certainty, STRIPS/PDDL, forward planning

Uncertain knowledge and reasoning

Probabilities, random variables, joint probability distribution, independence and conditional independence

Bayesian networks, what do the nodes and arcs mean, number of probabilities to specify vs joint probability distribution, correct/incorrect networks, good vs better networks, causal networks

Assignment #2:

- **Q1: Correct/incorrect, good/better Bayesian networks**
- **Q2: Modeling & inference in Bayesian networks**
- **Q3: Modeling with Bayesian networks**

Planning with uncertainty, Decision networks: Bayesian network + actions + utilities, what do the arcs and the nodes mean, evaluation of a decision network, MEU principle, value of information, utility theory, sequential decision making

Multi-agent systems, game theory, Nash equilibrium, Pareto optimal outcomes, utility, stochastic strategies, aggregating preferences, mechanism design

Assignment #3:

- **Q1: Decision networks, policies, value of information**
- **Q2: Modeling with decision networks, policies, value of information**
- **Q3: Game theory: Nash equilibrium, Pareto optimal**

Learning

Supervised learning, inductive learning, find a hypothesis from a hypothesis space that approximates some unknown function f; training, validation, and test sets; classification error, continuous error, underfitting, best fit, overfitting, features/attributes

Learning Bayesian networks, naïve Bayes

Decision trees, ID3, best feature, information gain heuristic, handling noise and other extensions

Neural networks, multi-layered, feed-forward networks, hidden units, training

SVM's and ensembles

Assignment #4:

- **Q1: Naïve Bayes and decision trees**
- **Q2: Decision trees, labeling leaves**
- **Q3: Neural network for digit classification**

Communication with natural language