

Learning Objectives and Assessment for 16.410

Principles of Autonomy and Decision Making

Learning Objectives:

Be able to: 1) model decision making problems using major modeling formalisms of artificial intelligence and operations research, including propositional logic, constraints, linear programs and Markov processes, 2) evaluate the computational performance of search, satisfaction, optimization and learning algorithms. 3) apply search, satisfaction, optimization and learning algorithms to real world problems.

Measurable Outcomes (assessment method):

Upon successful completion of 16.410, students will be able to:

- a. Describe at an intuitive level the process of artificial intelligence and operations research: a real-time cycle of problem understanding, formulation, solution and implementation. (*homework*)
- b. Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented (*homework, quiz*).
- c. Manipulate the basic mathematical structures underlying these methods, such as system state, search trees, plan spaces, model theory, propositional logic, constraint systems, Markov decision processes, decision trees, function approximators, linear programs and integer programs (*homework, quiz*).
- d. Demonstrate the hand execution of basic reasoning and optimization algorithms on simple problems (*homework, quiz*).
- e. Formulate more complex, but still relatively simple problems, and apply implementations of selected algorithms to solve these problems (*homework, lab*).
- f. Evaluate analytically the limitations of these algorithms, and assess tradeoffs between these algorithms (*homework, quiz*).

Concepts:

Search and Reasoning: uninformed and informed search, game tree search, local stochastic search and genetic algorithms, constraint satisfaction, propositional inference, rule-based systems, planning, and model-based diagnosis.

Optimization: Linear programming, integer programming, Markov Decision Processes

Learning: decision tree learning, reinforcement learning, neural nets.

Pedagogical methods:

- Computer projected presentations.
- Chalk-talk
- Prepared notes handed out to class
- Text
- Web-based recitations,
- Web-based problem sets.
- Videos and computer demonstrations
- Computational lab in scheme.