Lecture 16B: Final Review

CSCI 360

Introduction to Artificial Intelligence

USC

Here is where we are…

	3/1		Project 2 Out	
9	3/4	3/5	Quantifying Uncertainty	[Ch 13.1-13.6]
	3/6	3/7	Bayesian Networks	[Ch 14.1-14.2]
10	3/11	3/12	(spring break, no class)	
	3/13	3/14	(spring break, no class)	
11	3/18	3/19	Inference in Bayesian Networks	[Ch 14.3-14.4]
	3/20	3/21	Decision Theory	[Ch 16.1-16.3 and 16.5]
	3/23		Project 2 Due	
12	3/25	3/26	Advanced topics (Chao traveling to National Science Foundation)	
	3/27	3/28	Advanced topics (Chao traveling to National Science Foundation)	
	3/29		Homework 2 Out	
13	4/1	4/2	Markov Decision Processes	[Ch 17.1-17.2]
	4/3	4/4	Decision Tree Learning	[Ch 18.1-18.3]
	4/5		Homework 2 Due	
	4/5		Project 3 Out	
14	4/8	4/9	Perceptron Learning	[Ch 18.6]
	4/10	4/11	Neural Network Learning	[Ch 18.7]
15	4/15	4/16	Statistical Learning	[Ch 20.2.1-20.2.2]
	4/17	4/18	Reinforcement Learning	[Ch 21.1-21.2]
16	4/22	4/23	Artificial Intelligence Ethics	
	4/24	4/25	Wrap-Up and Final Review	
	4/26		Project 3 Due	
	5/3	5/2	**Final Exam** (2pm-4pm)	in the lecture classroom
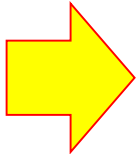
What we expect of you

- 20% Exam #1 (midterm)
- 20% Exam #2 (final)
- 5%   Quizzes (in-class, unannounced)

- 10% Project 1 (two-week coding)
- 10% Project 2 (two-week coding)
- 15% Project 3 (two-week coding)

- 10% Homework 1 (exam-style problems)
- 10% Homework 2 (exam-style programs)

Learning Objectives

After completing this course, you will be able to:

- Understand the basic mechanisms of intelligent agents
  - *Search*
  - *Logical reasoning and planning*
  - *Probabilistic reasoning*
 - *Machine learning*

Learning Objectives

Basic mechanisms of intelligent agents:

- *Search*
  - *A* algorithm, hill-climbing, simulated Annealing, genetic algorithm, minimax algorithm, alpha-beta pruning, …*
- *Logical reasoning and planning*
  - *Propositional logic, first-order logic, resolution proof, forward and chaining, ontology and semantic network, …*
- *Probabilistic reasoning*
  - *Quantifying uncertainty, Bayesian networks, probabilistic inference, decision theory, Markov decision process, …*
- *Machine learning*
  - *Decision tree learning, perceptron, neural networks, statistical learning, reinforcement learning, …*
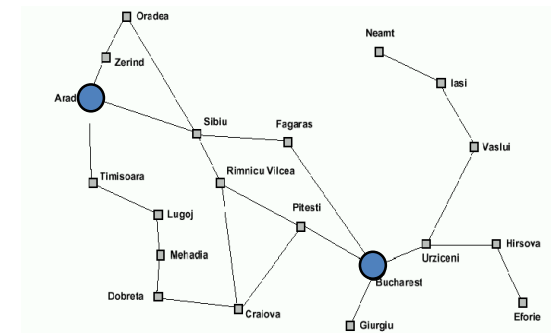
Course Overview

Introduction

- **1a - Introduction.** [Ch 1.1-1.4] What is AI? The Turing test. Rationality. Branches of AI. Research disciplines connected to and at the foundation of AI. Brief history of AI. Challenges for the future.
  Intelligent Agents. [Ch 2.1-2.4] What is an intelligent agent? Examples. Doing the right thing (rational action). Performance measure. Autonomy. Environment and agent design. Structure of agents. Agent types. Reflex agents. Reactive agents. Reflex agents with state. Goal-based agents. Utility-based agents.
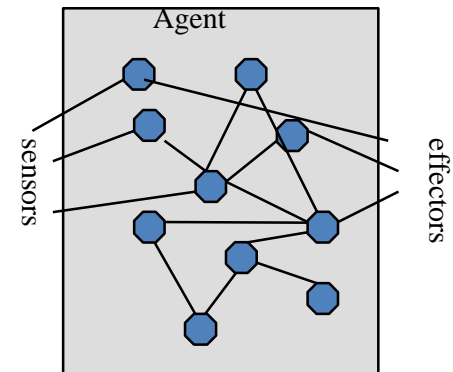
Course Overview (cont.)

Search

- **1b - Problem solving and search.** [Ch 3.1-3.3] Types of problems. More example problems. Basic idea behind search algorithms. Complexity.

- **2a - Uninformed search.** [Ch 3.3-3.4] Depth-first. Breadth-first. Uniform-cost. Depth-limited. Iterative deepening. Examples. Properties.

- **2b/3a/3b - Informed search.** [Ch 3.5-3.6; Ch 4.1-4.2] Best-first. A* search. Heuristics. Hill climbing. Simulated annealing. Genetic algorithms.
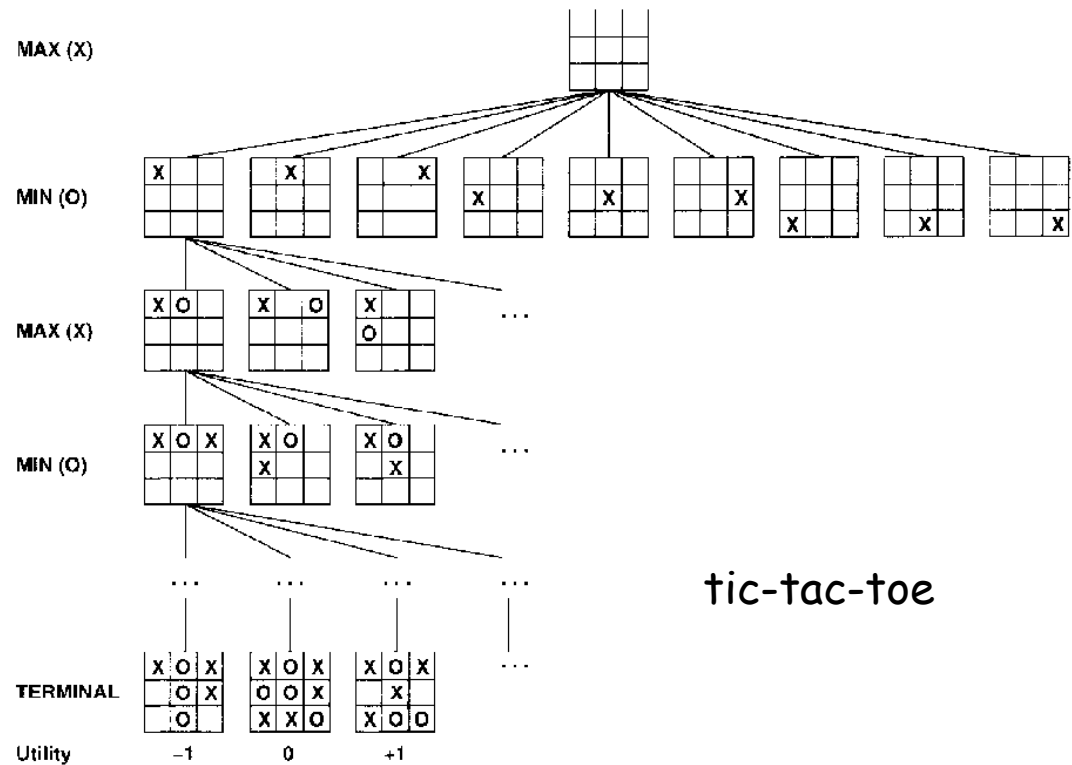

Traveling salesperson problem

Course Overview (cont.)

Adversarial Search

- **4a - Game playing.** [Ch 5.1-5.3] Minimax algorithm. Alpha-beta pruning. Elements of chance and non-determinis


tic-tac-toe

Course Overview (cont.)

Logical Reasoning

- **4b/5a - Knowledge-based agents** [Ch 7.1-7.5] Logic and representation. Propositional (Boolean) logic. Inference. Syntax. Semantics. Examples.

- **5b - First-order logic** [Ch 8.1-8.4] Syntax. Semantics. Examples. Atomic sentences. Complex sentences. Quantifiers. Examples. FOL knowledge base.

- **6a - Rule-based systems.** [Ch 9] Proofs. Unification. Generalized modus ponens. Forward and backward chaining.
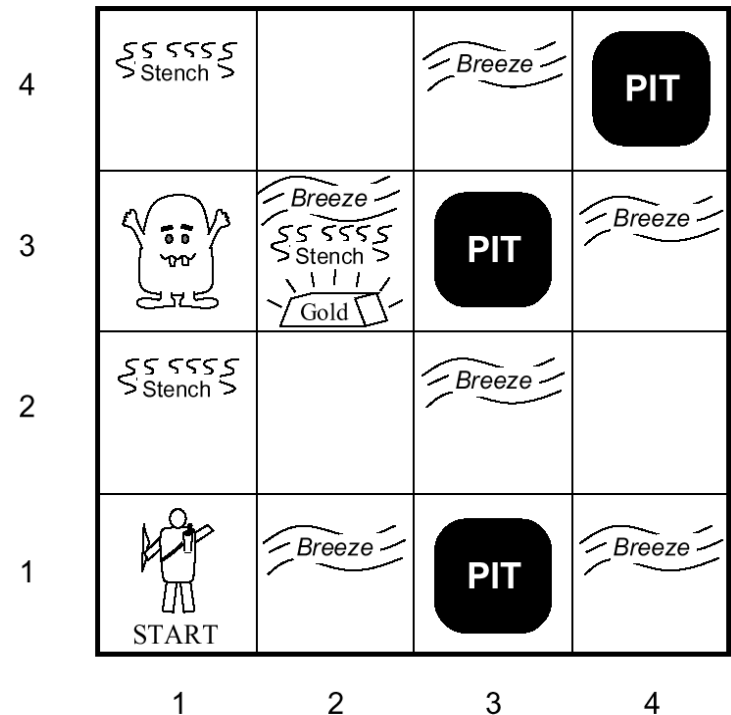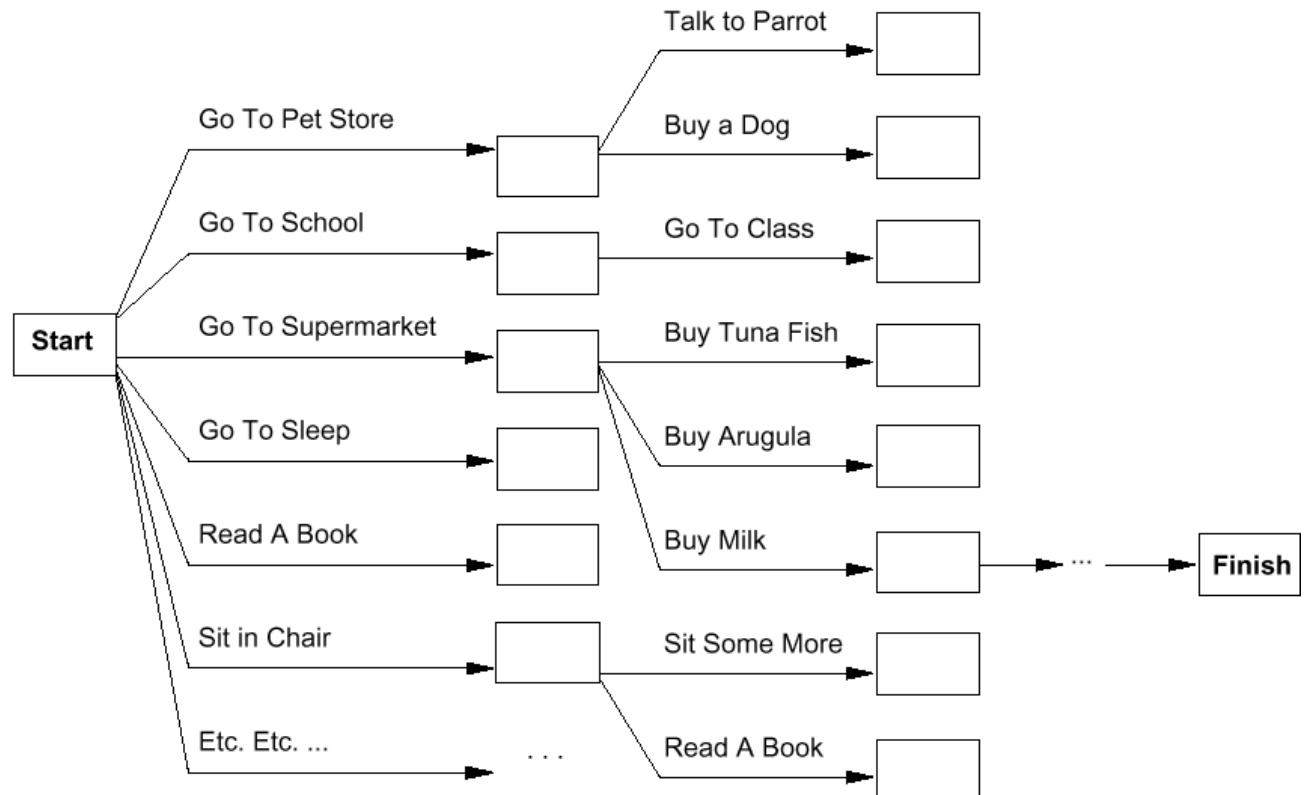
wumpus world

Course Overview (cont.)
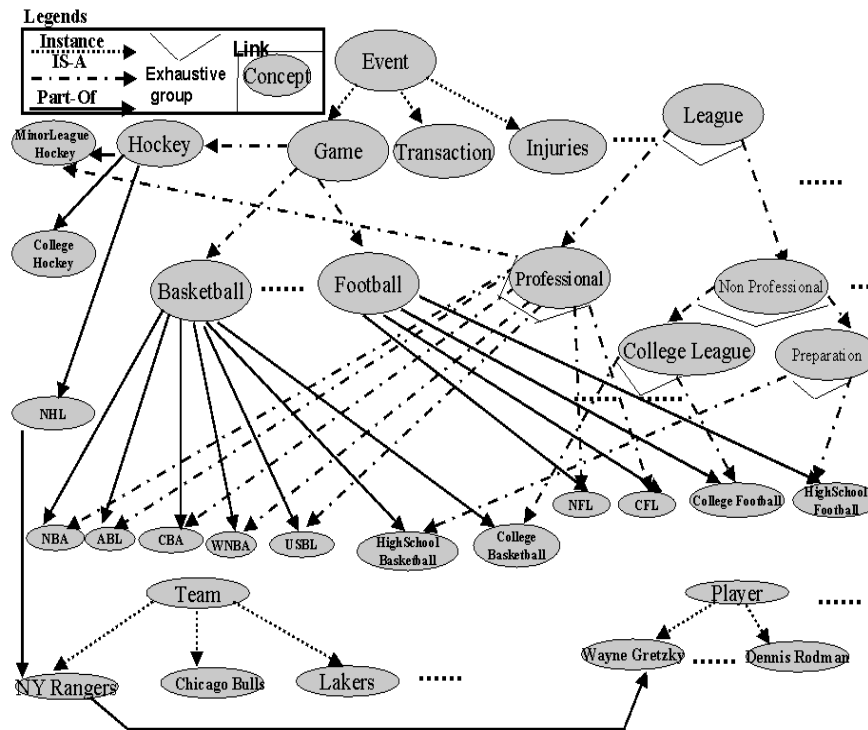
Systems that can plan for the future

- **6b/7a - Planning.** [Ch 10] Definition and goals. Basic representations for planning. Situation space

Course Overview (cont.)

Representing Knowledge

- **7b - Building a knowledge base.** [Ch 12.1-12.5] Knowledge bases. Vocabulary and rules. Ontologies. Organizing knowledge.


An ontology for the sports domain

Course Overview (cont.)

Handling uncertainty.

- **9a/9b/12a - Probabilistic reasoning.** [Ch 13, 14]
  Reasoning under uncertainty – probabilities, conditional independence, Bayesian networkss. Inference in Bayesian networks

- **12b/13a - Probabilistic decision making.** [Ch 16] – utility theory, decision networks, value/policy iteration, Markov decision processes (MDP)

Markov Decision Process (discrete)
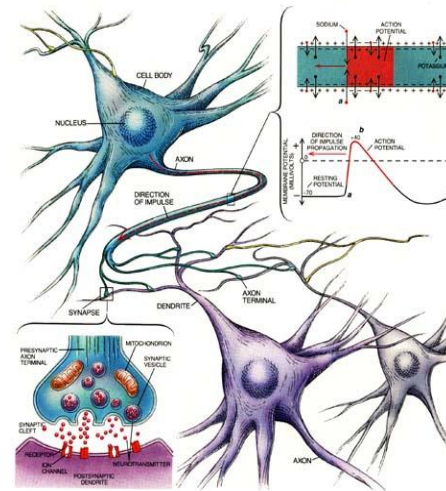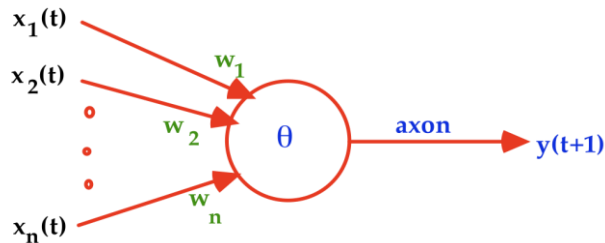
[Bellman 57] [Howard 60] [Sutton/Barto 98]
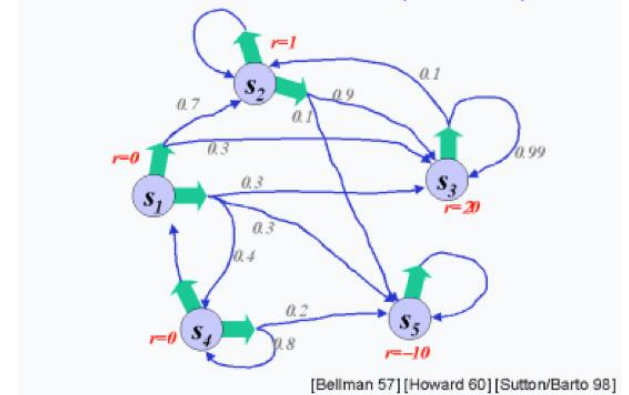
Course Overview (cont.)

Supervised Learning

13b - Decision tree learning [Ch 18.1-18.3]. Learning from examples, learning decision tree
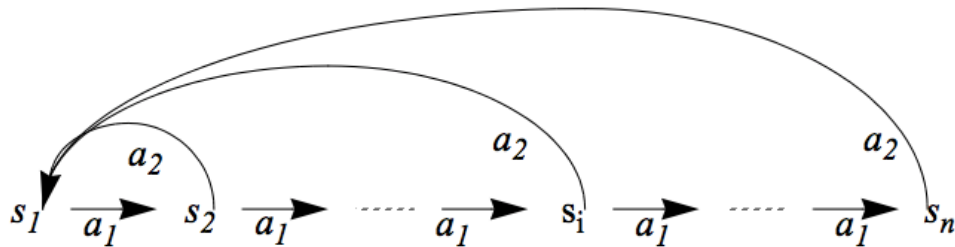
14a/14b - Neural networks. [Ch 18.7] Introduction to perceptron, neural networks, gradient descent, etc.

Course Overview (cont.)

Probability-based Learning

- **15a – Statistical learning.** [Ch 20.2]

- **15b – Reinforcement learning.** [Ch 21.1-21.2]

How to prepare for final exam?

1. Start with the "list of topics covered by the final exam"
2. Go through the "lecture slides"
3. Go through the "quizzes"

4. If needed, read the "related chapters in the textbook"