

# CSCI-561 Foundations of Artificial Intelligence – USC – Fall 2019 Syllabus and Schedule

Lectures: Prof. Laurent Itti, Bovard Auditorium, 2:00 – 4:50pm, NOTE: days vary, see below.

Discussion sections: Prof. Wei-Min Shen

Textbook: Artificial Intelligence: A Modern Approach, 3<sup>rd</sup> Ed. (AIMA)  
Optional Reading: Autonomous Learning from the Environment (ALFE)

Date	Topic	Reading
Monday Aug 26	1. Welcome – Introduction. Why study AI? What is AI? The Turing test. Rationality. Branches of AI. Brief history of AI. Challenges for the future. What is an intelligent agent? Doing the right thing (rational action). Performance measure. Autonomy. Environment and agent design. Structure of agents. Agent types.	AIMA 1, 2 (ALFE 1)
	2. Problem Solving & Search – Types of problems. Example problems. Basic idea behind search algorithms. Complexity. Combinatorial explosion and NP completeness. Polynomial hierarchy.	AIMA 3 (ALFE 2, 6)
Wednesday Sept 4	3. Uninformed Search - Depth-first. Breadth-first. Uniform-cost. Depth-limited. Iterative deepening. Examples. Properties.	AIMA 3 HW1 out
	4. Informed search – Best-first. A* search. Heuristics. Hill climbing. Problem of local extrema. Simulated annealing. Genetic Algorithms.	AIMA 3, 4 (ALFE 6)
Monday Sept 9	5. Game Playing - The minimax algorithm. Resource limitations. Alpha-beta pruning. Chance and non-deterministic games.	AIMA 5
	6. Constraint satisfaction. Node, arc, path, and k-consistency. Backtracking search. Local search using min-conflicts.	AIMA 6
No formal class week of Sept 16	7. Video review: Uninformed search. Note: Bovard Auditorium is not available that week. Pre-recorded videos will be provided.	AIMA 3
	8. Video review: Informed search. Note: Bovard Auditorium is not available that week. Pre-recorded videos will be provided.	AIMA 3, 4 (ALFE 6)
Thursday Sept 26	9. Agents that reason logically 1 – Knowledge -based agents. Logic and representation. Propositional (boolean) logic.	AIMA 7 (ALFE 3) HW1 due
	10. Agents that reason logically 2 – Inference in propositional logic. Syntax. Semantics. Examples.	AIMA 7 HW2 out
Week of Sept 30	Midterm exam 1	
Monday Oct 7	11. First-order logic 1 – Syntax. Semantics. Atomic sentences. Complex sentences. Quantifiers. Examples. FOL knowledge base. Situation calculus.	AIMA 8, AIMA 12
	12. First-order logic 2 – Describing actions. Planning. Action sequences.	AIMA 8
Tuesday Oct 15	13. Inference in first-order logic – Proofs. Unification. Generalized modus ponens. Forward and backward chaining.	AIMA 9
	14. Continue Inference in first-order logic. Resolution. Proof by contradiction.	AIMA 9
Monday Oct 21	15. Logical reasoning systems – Indexing, retrieval and unification. The Prolog language. Theorem provers. Frame systems and semantic networks.	AIMA 9 HW2 due
	16. Planning – Definition and goals. Basic representations for planning. Situation space and plan space. Examples.	AIMA 10 (ALFE 6) HW3 out

Monday Oct 28	17. Fuzzy logic – concepts, fuzzy inference, aggregation, defuzzification.	Handout
	18. Learning from examples – supervised learning, learning decision trees, support vector machines.	AIMA 18 + handout (ALFE 4)
Week of Nov 4	Midterm exam 2	
Thursday Nov 14	19. Learning with neural networks – perceptrons, Hopfield networks. How to size a network? What can neural networks achieve?	Handout + AIMA 18
	20. Advanced concepts in neural networks – convnets, deep learning, stochastic gradient descent, dropout learning, autoencoders, applications and state of the art.	Handout
Thursday Nov 21	21. Reasoning under uncertainty – probabilities, conditional independence, Markov blanket, Bayes nets.	AIMA 13, 14
	22. Continue Reasoning under uncertainty – Probabilistic inference, enumeration, variable elimination, approximate inference by stochastic simulation, Markov chain Monte Carlo, Gibbs sampling.	AIMA 14, 15 (ALFE 5)
Monday Nov 25	23. Probabilistic decision making – utility theory, decision networks, value iteration, policy iteration, Markov decision processes (MDP), partially observable MDP (POMDP).	AIMA 16, 17 (ALFE 5)
	24. Probabilistic Reasoning over time: Temporal models, Hidden Markov Models, Kalman filters, Dynamic Bayesian Networks, Automata theory.	AIMA15 HW3 due
Monday Dec 2	25. Probability-Based Learning: Probabilistic Models, Naïve Bayes Models, EM algorithm, Reinforcement Learning.	AIMA 20-21 (ALFE 5.10, 6.1)
	26. Towards intelligent machines – The challenge of robots: with what we have learned, what hard problems remain to be solved? Different types of robots. Tasks that robots are for. Parts of robots. Architectures.	AIMA 24, 26, 27 (ALFE 13)

**Midterm 1:** Week of Sept 30, day TBA, time TBA, Room TBA

**Midterm 2:** Week of Nov 4, day TBA, time TBA, Room TBA

**Final exam:** during finals week, day TBA, time TBA, Room TBA

**Grades:** 20% for midterm 1, 20% for midterm 2, 30% for final, 10% for each of the 3 homeworks. Some of the exam questions will be on topics covered in the discussion sessions only and not in the main lectures.

**Homeworks:** These are programming assignments, you will program some A.I. agents for search, game playing, logic inference (subject to change) from scratch. Good programming knowledge is necessary. We will use vocareum.com where you can edit, compile, and test your code in the cloud. Supported languages include C, C++, C++11, Java, and Python.

**Tentative homework topics (subject to change):**

HW1 search

HW2 game playing or constraint satisfaction problems

HW3 logic inference or neural networks

**Grading is absolute and according to the following scale:** 90 or more: A+; 80 or more: A; 75 or more: A-; 70 or more: B+; 60 or more: B; 55 or more: B-; 50 or more: C+; 40 or more: C; 35 or more: C-; less than 35: F.