CSW4701

ARTIFICIAL INTELLIGENCE

Spring 2009
Tuesday/Thursday 2:40-3:55PM
535 MUDD
CVN Course

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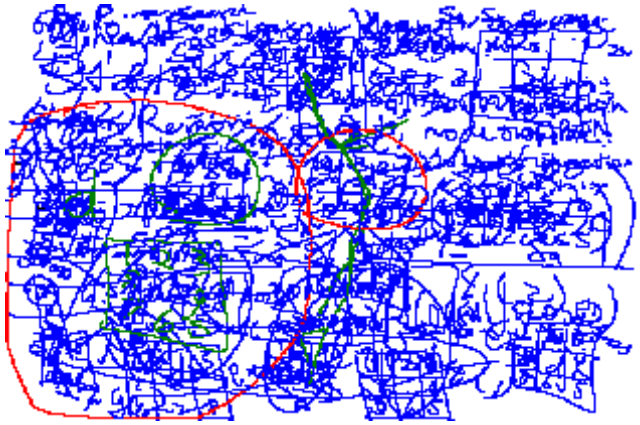
URL of this page:

http://www.cs.columbia.edu/~sal/AI-Spring09.htm

FINAL EXAM SCHEDULE

(Probably the last class)



Can you guess what this picture means?

To access the course discussion board
1. Go to http://courseworks.columbia.edu and log in
2. Click the link for COMS W4701 course listing
3. Click the link for "Discussion" on the left-hand side

TEXT

***Artificial Intelligence, A Modern Approach*,**
Russell and Norvig, (Prentice Hall), SECOND EDITION,
ISBN: 0-13-790395-2

URL: http://aima.cs.berkeley.edu/

Syllabus

- Overview of AI: Strong, Weak, History, Approaches
- Introduction to LISP: Programming and Examples
- Assignment #1: A moderately complex Lisp programming project, pattern matching, memory retrieval, etc.
- Problem Solving:
    * Problem Formulation as Search, State Spaces, Problem Reduction
    * Basic Weak Search Methods & Algorithms: Breadth, Depth, Best-first, Generate and Test, Hill Climbing, etc.
    * Lisp Implementations
    * Assignment #2: Implementation of a basic search method for a moderate-scale problem, comparative evaluation of alternative search algorithms.
    * Game Playing: Minimax, Alpha-Beta
    *Assignment #3: Game Playing Tournament, TBA
- First Order Logic
    * Mechanical Theorem Proving
    * Unification
- Midterm: Closed Book
- Knowledge Representation:
    * Structured Representations: Semantic Nets, Frames, Blackboards, Rules
    * Subsumption and Classification
    * Lisp Implementation of nets, frames or rules.
- Machine Learning and Generalization
    * Inductive Inference
    * Version Spaces, ID3, CART, etc. as examples
    * Bayesian Learning
    *Support Vector Machines
    * Assignment #4: Lisp Implementation of a machine learning program classifier
- Final Exam: Closed Book, Entire Material Presented in Class

There are many code examples on the AIMA website to guide your work in LISP. LISPworks (http://www.lispworks.com/) is free and probably the easiest LISP implementation for you to use.

The course structure by lecture is specified in the table below, annotated with required book chapters from Russel & Norvig's AIMA text. Useful slides/code/background material are provided in the right most column. Some of these are likely to change from time to time.

The basic required chapters include chapters 1-4, 5-10, 13 and 18.

We will follow a general theme throughout the progression of the course describing alternative styles of logical inference, from *Deductive* Inference, to *Abductive* and finally *Inductive* Inference in the context of an intelligent agent architecture. Auto-epistemic will have to wait for another course.

DETAILED COURSE SCHEDULE

Session	Date	Topic/chapter	Free code/ HW Project Assigned or Due
1	1/20	Overview of AI (Chapter 1 and 2)	Intro-Slides and Agents
2	1/22	Intro to LISP	How to run Lisp Download personal edition Lisp from www.lispworks.com LISP Primer Load and compile in Lispworks See http://www.cs.berkeley.edu/~russell/code/doc/install.html
3	1/27	LISP examples	
4	1/29	Equality/Pattern matching	**Project#1: Pattern Matcher** Some useful string functions
5	2/3	Intro Problem Solving (Chp 2) State Space Search	Search slides
6	2/5	Weak search methods&algs (BFS, DFS, etc.) (Chp 3)	Basic search, Iterative DFS search, 8 Puzzle state Convert states to symbols
7	2/10	IDDFS, Complexity measures	

8	2/12	Uniform cost, Greedy, Bidirectional Search	**Project #1 DUE**
9	2/17	Heuristic Search A* (Chp 4)	**Project#2: Search programs**, Some useful clock functions An improved NORTH operator for 15 puzzle Uniform cost, Greedy search, Bidirectional search Heuristic search slides
10	2/19	Problem-reduction problem solving,	A star search, Iterative A star search Minimax/Alpha-Beta CSP slides
11	2/24	AND/OR Constraint satisfaction problems	Game Playing Slides
12	2/26	Game Playing (Chp 6)	**Project #3: CHECKERS OR ISOLATION** **Project #2 DUE**
13	3/3	Minimax/Alpha-beta	
14	3/5	Intro to Knowledge Representation	Proposition Logic Slides
15	3/10	**MIDTERM**	All material on search, up to the lecture on 3/1 1 hr 15 min. time limit Knowledge representation and propositional logic NOT covered on the exam.
16	3/12	More Intro to Knowledge Representation	FOL slides
	3/16-3/20	**SPRING BREAK**	
17	3/24	Propositional Logic Mechanical Theorem Proving	Theorem Proving Code & examples
18	3/26	Resolution Thm. Proving (Chp 7)	Inference Slides **Project #3 DUE SUNDAY 29 MARCH FOR ALL STUDENTS (INCLASS AND CVN).**
19	3/31	First Order Logic, Godel Thms. (Chp	

		8) Resolution Thm Proving in FOL (Chp 9) Unification, Herbrand Universe	
20	4/2	More logic	**TOURNAMENT PLAYOFFS FRIDAY APR 4**
21	4/7	Semantic nets/Frames Inference in nets (Chp 10)	Intersection search
22	4/9	Frames, Rule-based Systems Backward chaining, Prolog	
23	4/14	Uncertainty and Bayesian Inference (Chp 13)	Uncertainty slides Bayesian inference slides
24	4/16	Intro to Machine Learning (Chp 18)	Learning Slides **Project #4: Decision Tree Learning**
25	4/21	Generalization, Inductive Inference	Chpt19-slides
26	4/23	Decision Tree Learning	
27	4/28	Naive Bayes Classifier	**NB-slides**
28	**4/30**	**LAST CLASS – INCLASS FINAL EXAM**	
**	**5/1 – 5/4**	**STUDY DAYS**	**Project #4 DUE THU 30 APR**
**	**5/5 – 5/8**	**FINALS WEEKS**	End of Spring 08 TERM. Summer Break begins.

Various Common Lisp programs and other useful notes are available from this page as ascii text files.
Just click on the links in the schedule table above!

The authors of AIMA have also provided access to the code in the textbook.

GRADING POLICY

Click Here

Project Submission Instructions

Click Here

Just visit their link
http://www.cs.berkeley.edu/~russell/code/doc/install.html for details.

TA DETAILS

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FINAL GRADE DISTRIBUTION

Final grades are curved. The distribution is tentatively set at

HW/Test	Percentage
Project #1	15%
Project #2	15%
Project #3	20%
Project #4	15%
MIDTERM	15%
FINAL	20%