ITK 340
Introduction to Artificial Intelligence
Spring, 2009

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Catalog Description:
Introduction to concepts in artificial intelligence, including knowledge representation, heuristic search, neural networks, planning algorithms, natural language, and machine learning.

Prerequisites: ITK 279 is required to prepare you for this course. We will make use of data structures such as stacks, queues, priority queues and graphs. You should be familiar with the concept of NP-complete and/or NP-hard problems, since most problems in artificial intelligence are, in fact, NP-hard.

Extended Description: This course will introduce you to the field of artificial intelligence. We will cover fundamental concepts of the field such as problem-solving as search, heuristic search, and knowledge representation. We will also look at some of the major subareas of AI, focusing on machine learning, natural language processing and planning. You will be introduced to the Prolog programming language, one of the primary AI languages. You will be required to use Prolog for two of your programming assignments. On the other assignments, you will have a choice of languages.

Textbook:
Russell and Norvig, *Artificial Intelligence: A Modern Approach*. 2nd Ed. Prentice Hall, 2004.

Course Objectives:
Upon completion of this course, students should be able to:

1. Describe several important historical AI systems.
2. Explain limitations of current AI systems.
3. Select appropriate search techniques and/or heuristics to solve particular problems.
4. Correctly represent knowledge using several different knowledge representations.
5. Write programs that implement various AI algorithms.
6. Correctly use various rules of inference, including generalized modus ponens and resolution.

7. Discuss the philosophical issues and sociological implications raised by the future of artificial intelligence development.
8. Evaluate alternative approaches for representing uncertainty.
9. Explain various machine learning algorithms.
10. Select an appropriate machine learning algorithm for a given problem.
11. Explain some of the challenges of natural language processing.
12. Describe various sources of ambiguity and discuss approaches to resolving these ambiguities in a natural language understanding system.

Course Requirements:
There will be three examinations, including the final, which will be comprehensive. The course will also include several programming assignments. Graduate students taking the course will be expected to complete an additional project and related paper.

Students will be expected to read the assigned material **before** class and come prepared to participate in class discussion. Homework will be assigned regularly and discussed in class. Pop quizzes are always possible, particularly if students are consistently unprepared.

Pair Programming:
In this course, you will have the opportunity to do programming in pairs. The idea here is that you will sit together at one computer, one person "driving" and the other watching, commenting, noting mistakes, and generally helping. Both people must spend time in each role. Note that you may only do one program with a given partner, so if you choose to do every program with a partner, you will have to have several different partners.

Course Grading Guidelines:
A full distribution of grades from A to F is possible with A's being reserved for outstanding performance. A grade of C represents the minimal acceptable performance. The following rubric describes the levels of performance typically associated with each grade:

A Outstanding performance. Student demonstrates solid conceptual understanding and insight. The student not only demonstrates mastery of the course content, but is able to make extensions or apply that knowledge to new situations. Assignments and tests are of excellent quality and the student contributes substantially to class discussions.

B Good performance. Student demonstrates good understanding and mastery of the course content. Assignments and tests are of good quality but not exceptional. The student regularly contributes positively to the class discussion.

C Adequate performance. Student demonstrates adequate understanding and mastery of course content but has difficulty extending or applying the knowledge to new situations. Assignments and tests are adequate. Student may not contribute as regularly to class discussions.

D Inadequate performance. Student demonstrates inadequate understanding of course content. Assignments and/or tests are inadequate, but show effort. Student contributes little to class discussions.

F Unacceptable performance. Student demonstrates little or no understanding of the course content. Assignments are not completed, are late, or of poor quality. The student does not contribute to class discussion. The student's work provides little evidence of effort.

Evaluation:
The various components of your grade will be weighted as follows:

	Undergraduate	Graduate
Final:	20%	20%
Midterms:	30%	25%
Programs:	35%	30%
Homework, quizzes, and participation:	15%	15%
Project:		10%
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	100%	100%

Each assignment or test item will be graded in a holistic manner, based on a rubric. A general version of the rubric is provided below. (A rubric specific to programs will be provided with the first programming assignment. A specific rubric will also be provided for each paper.)

A (5) **Outstanding performance**. Student demonstrates solid conceptual understanding and insight. All required components are clearly present. Material is well written, demonstrating coherent thoughts and reasoning as well as utilizes proper grammar and correct spelling. Programs not only work perfectly, but are well-designed and documented.

B (4) **Good performance**. Student demonstrates good understanding and insight. All required components are present. Material is well written, demonstrating coherent thoughts and reasoning. Programs work at least on standard data and provided test cases and are well-designed and documented.

C (3) **Adequate performance**. Student demonstrates adequate understanding and insight. Most required components are present. Material is written coherently, demonstrating adequate writing skills, but may contain numerous grammatical or spelling errors. Programs may contain a major execution error or several minor execution errors or may be poorly designed or documented.

D (2) **Inadequate performance**. Student demonstrates inadequate understanding and insight. Required components are not present. Writing indicates little thought and reflection, or is of poor quality, making it difficult to read and understand. Programs run, but contain serious flaws.

F (1 or 0)**Totally unacceptable performance**. Student demonstrates little to no understanding of the content. Work is not turned in, or most of the required components are missing. Writing indicates virtually no effort. Programs do not run or do not compile.

Grading scale:

A: 4.5 or greater
B: 3.75-4.49
C: 3.0-3.74
D: 2.0-2.99
F: less than 2.0

Class Policies:
Programs, papers, and other assignments completed outside class are due at the **beginning** of the class period on the due date. Each student will have two "late passes" which allow assignments to be turned in up to **5 days** late. Use of the late passes will be explained in class. Homework assignments will not be accepted late.

Academic honesty is very important to me and to this university. You are expected to be aware of the student code, including the section on academic dishonesty (cheating and plagiarism). The minimum penalty for any form of academic dishonesty in this class will be a zero on the assignment in question. Do not work together on any project unless given explicit permission by me. Serious or repeated offenses will result in harsher penalties up to and including failure in the course. All cases of academic dishonesty will be reported to CRR as required by university policy and may result in disciplinary penalties as well as academic penalties.

Because people learn best when they are involved with what they are learning, I expect you to take an *active* part in every class session. You will be expected to read the assigned chapter in the text *before* you come to class, so that you can participate in the discussions and activities we have. *There may be topics covered in class which are not in the text, and topics assigned in the text which we will not discuss in class*. So your best bet for getting the grade you want is to both read the text *and* come to class.

Note that while this class is an *introduction* to artificial intelligence, it is still (and appropriately) a 300-level course with significant prerequisites. In this course, you will come to understand the use of several data structures and algorithms from ITK 279. Do not allow yourself to be seduced into thinking that the word *introduction* means easy. This course covers interesting material and can be a lot of fun, but it is also a challenging subject. Be prepared to put forward a serious effort.

Please respect class time. Attend regularly, be prompt, and put cell phones on vibrate.

I will be using two different web sites to provide course information to you via the web. Some course information including copies of this document and the slides can be found on the course web site at http://www.itk.ilstu.edu/faculty/mecalif/ITK340/Spring2009/index.htm. I will also use Blackboard to provide some course material, including access to your grades in the course as well as assignment submission. You can access Blackboard by going to http://blackboard.ilstu.edu and logging in. Your login ID and password are the same as your ULID and associated password.

Contacting me:
I try hard to keep my office hours free for you – please come see me for help as needed. Do not call in advance; I typically won't answer the phone if there is a student in my office or if I've stepped out for just a minute, so my not answering the phone does not indicate that I'm not there.

I answer email frequently when I am home – responses will be less prompt when I am on campus, as I seldom have time to check email while on campus between classes, committee meetings, and office hours. When asking questions about programs via email, please be as specific as possible about your question or bug.

I am typically available for instant messaging when sitting at my home computer – which is a great deal of many evenings and most of the time on days when I am not on campus. While IM is not as effective as face-to-face help in most cases, it can work better than email for getting help. See the information at the beginning of this document for my IDs on various systems.

Disability Concerns:
Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TDD).

Tentative Schedule

Week	Date	Topics	Reading
Week 1	Jan 12	Introduction Intelligent Agents	Ch. 1 Ch. 2
Week 2	Jan 19	**No class Monday – MLK Day** Problem Solving as Search	 Ch. 3
Week 3	Jan 26	Informed Search Adversarial Search	Ch. 4 Ch. 6
Week 4	Feb 2	Logical Agents First Order Logic	Ch. 7 Ch. 8
Week 5	Feb 9	Introduction to Prolog	Handout
Week 6	Feb 16	Inference Knowledge Representation	Ch. 9 Ch. 10
Week 7	Feb 23	Planning	Ch. 11
Week 8	March 2	Uncertainty	Ch. 13-14
		Spring Break	
Week 9	March 16	Uncertainty Learning from Observations	Ch. 15 Ch. 18
Week 10	March 23	Knowledge in Learning	Ch. 19
Week 11	March 30	Statistical Learning	Ch. 20
Week 12	April 6	Language Understanding	Ch. 22
Week 13	April 13	Language Understanding cont.	Ch. 22
Week 14	April 20	Learning and Language	Ch. 23
Week 15	April 27	Philosophy Wrap-up	Ch. 26 Ch. 27
	May 4	FINAL EXAM at 1 pm	