ITK 340
Introduction to Artificial Intelligence
Spring, 2011

Instructor: Dr. Mary Elaine Califf
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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. 3rd Ed. Prentice Hall,
2010.

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. Do not split the assignment and each do part of it. I consider that cheating, and a violation of my trust that those who work together are honestly trying to do pair programming as specified. If problems with a programming partner, see me.

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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Undergraduate</th>
<th>Graduate</th>
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</thead>
<tbody>
<tr>
<td>Final</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Midterms</td>
<td>30%</td>
<td>25%</td>
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<tr>
<td>Programs</td>
<td>35%</td>
<td>30%</td>
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<tr>
<td>Homework, quizzes, and participation</td>
<td>15%</td>
<td>15%</td>
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<tr>
<td>Project</td>
<td>10%</td>
<td>10%</td>
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<tr>
<td></td>
<td>100%</td>
<td>100%</td>
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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. Electronic submissions will actually be due 10 minutes before class time (to allow you time to get from the lab to class). 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.

There will be homework assignments due most class days. The assignments vary in purpose. Some are practice. Some encourage you to explore concepts for yourself. Many will be individual; on some I will allow group work. Make sure that you know that group work is allowed on a given assignment before working together. Please note that I want only one copy of an assignment from a given group, with all student names. Do not work together or give help on a homework assignment and then turn in separate copies of the assignment—I consider that cheating. Note that you are encouraged to come to me for help on homework assignments as well as programs.

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 anything except where I have explicitly given permission. 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/Spring2011/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 may be less able to keep my office hours for you this semester compared to other times and I have more limited hours. However, I will be on campus more. Please take advantage of that by making appointments.

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, meetings, and office hours. When asking questions about programs via email, please be as specific as possible about your question or bug. Note that I will only look at code on the school UNIX machines – do not send me your code. Instead, make it visible on the UNIX machines and send me the full path to the files.

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. Please note that I do not have IM on my work computer. 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

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Reading</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Jan 10</td>
<td>Introduction</td>
<td>Ch. 1</td>
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<td>Intelligent Agents</td>
<td>Ch. 2</td>
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<tr>
<td>Week 2</td>
<td>Jan 17</td>
<td><strong>No class Monday – MLK Day</strong> Problem Solving as Search</td>
<td>Ch. 3</td>
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<tr>
<td>Week 3</td>
<td>Jan 24</td>
<td>Alternative searching approaches</td>
<td>Ch. 4</td>
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<td>Adversarial Search</td>
<td>Ch. 5</td>
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<td>Week 4</td>
<td>Jan 31</td>
<td>Logical Agents</td>
<td>Ch. 7</td>
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<td>First Order Logic</td>
<td>Ch. 8</td>
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<tr>
<td>Week 5</td>
<td>Feb 7</td>
<td>Introduction to Prolog</td>
<td>Handout</td>
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<tr>
<td>Week 6</td>
<td>Feb 14</td>
<td>Inference</td>
<td>Ch. 9</td>
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<tr>
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<td>Planning</td>
<td>Ch. 10</td>
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<td>Week 7</td>
<td>Feb 21</td>
<td>Knowledge Representation</td>
<td>Ch. 12</td>
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<td>Uncertainty</td>
<td>Ch. 13</td>
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<td>Week 8</td>
<td>Feb 28</td>
<td>TBA</td>
<td>None</td>
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<td><strong>Spring Break</strong></td>
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<tr>
<td>Week 9</td>
<td>March 14</td>
<td>Learning from Examples</td>
<td>Ch. 18</td>
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<tr>
<td>Week 10</td>
<td>March 21</td>
<td>Knowledge in Learning</td>
<td>Ch. 19</td>
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<td>Week 11</td>
<td>March 28</td>
<td>Statistical Learning</td>
<td>Ch. 20</td>
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<tr>
<td>Week 12</td>
<td>April 4</td>
<td>Language Understanding</td>
<td>Ch. 22</td>
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<tr>
<td>Week 13</td>
<td>April 11</td>
<td>Language Understanding cont.</td>
<td>Ch. 22</td>
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<tr>
<td>Week 14</td>
<td>April 18</td>
<td>Language Understanding cont.</td>
<td>Ch. 23</td>
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<td>Week 15</td>
<td>April 25</td>
<td>Philosophy</td>
<td>Ch. 26</td>
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<td>Wrap-up</td>
<td>Ch. 27</td>
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<td></td>
<td>May 4</td>
<td>FINAL EXAM at 1 pm</td>
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