CS 475 — Artificial Intelligence I

Fall 1997

Instructor: Professor Jan Wiebe
SH 163; Telephone No. 646-6228; e-mail wiebe@cs.nmsu.edu
Office Hours: M 2-3; W 10-11
and by appointment (set up in e-mail)

Lectures: TTh 8:55-10:10, SH113

Required Text: *Artificial Intelligence, a modern approach*
S. Russell & P. Norvig, Prentice Hall, 1995.

Optional: A book about Common Lisp, such as:
LISP, 3rd edition, by P. Winston and B. Horn.
Common LISPcraft, by R. Wilensky.
A Programmer's Guide to Common Lisp, by D. Tatar.

Grading scheme:

Homework assignments	25%
Projects	25%
Midterm and logic quiz	20%
Final	30%

Desired Prerequisites: CS 372, CS 272, & Math 279/330.
If you don't have them, please see me.

Important Dates:

midterm	Thurs Oct 9
last day to drop with a W	Wed Oct 15
no class	Thurs Nov 27
final exam	Thurs Dec 11, 8-10am

NOTES:

Late Penalty: 10% per day up to 5 days (**including** Sat and Sun).

Your own work: All work you hand in must be your own, unless explicitly stated otherwise on an assignment.

Course Withdrawals: If you decide to withdraw from the course, you are responsible for ensuring that all steps are taken to formally withdraw. Do not assume that you will be dropped automatically.

I Grades: The grade of I (incomplete) may be given only if you are unable to complete the course due to documented circumstances beyond your control that develop after the last day to withdraw from the course. Appropriate circumstances include illness and death or crisis in your immediate family. Consult the university catalog for regulations regarding an I grade. In no case will an I grade be assigned to avoid a grade of D or F in the course.

S/U Grades: If you elect to be graded under the S/U option, you must declare your intention when registering for the course. All work in the class will be graded in a manner identical to that for students choosing the letter grade option. At the end of the semester, your final letter grade in the course will be used to assign either an S or a U. In accordance with Faculty of Arts and Sciences regulations, you must achieve a minimum grade of C in order to receive a grade of S.

Academic Conduct: The guidelines for academic conduct are stated in the NMSU Student Handbook. Any violations of the code as stated in the handbook will result in a grade of F for the course in addition to any further sanctions imposed by the university.

Miscellaneous: If you have, or think you have, a disability that interferes with your academic progress, you may contact Services for Students with Disabilities at 646-6840 (V) or 646-1918 (TTY) for an appointment. Services for Students with Disabilities is located in Garcia Annex, Room 102.

Current and appropriate documentation will be required in order to receive services.

Order of Topics

Readings in the text are listed below. Note that additional material will also be presented in class.

1. Part I: Introduction
   (a) Introduction to the course
   (b) Chapters 1 (History of AI) and 2 (Intro to intelligent agents) are better read on your own
   (c) What is AI?
   What are the problems and goals?

2. Part II: Problem Solving by Search (chapters 3 and 4)

   Assignment 1: Heuristic search.
   May involve some programming, but mainly will be a written assignment.

   (a) General framework: state-space search
   (b) Brief review of depth-first and breadth-first search
   (c) Depth-limited and iterative-deepening search
   (d) Bi-directional search
   (e) Heuristic functions
   (f) Best-first search:
      i. Hill-climbing (greedy search)
      ii. A* search and variants: IDA* and SMA* search
   (g) You will also be exposed to Lisp in this section

3. Part III: Knowledge representation and reasoning (KRR)

   Assignments 2 and 3 (written assignments):
   Resolution proofs and unification,

Representation in first-order logic,
Relations among frame-systems, semantic nets, and first-order logic

Project 1: Solving a problem in an existing KRR system

The midterm will be given part way through this section of the course.

(a) Representation, reasoning, and logic in the context of Propositional logic (Chapter 6)
   i. The relationship between syntax and semantics
   ii. Entailment (logically follows; $\models$)
   iii. Inference procedures ($\vdash$)
   iv. Soundness and completeness
   v. Validity and Satisfiability
   vi. Monotonicity

(b) Representation and reasoning in first-order predicate calculus
   i. Syntax and semantics (chapter 7, pp. 185-198)
   ii. **Memorization quiz on logic**, to make sure the basic concepts are at your fingertips.

(c) Resolution proofs and unification
(chapter 9, only pp. 265-276 are required; the rest of chapter 9 is beyond the scope of this course. Supplementary material will be handed out.)

(d) Chapter 7, 198-210:
Axioms, definitions, and theorems
Representing events and states: the situation calculus
The frame, qualification, and ramification problems

(e) Types of KRR systems (chapter 10, pp. 297-298, 304-305, excerpts from 310-327)

(f) Semantic nets and frames; inheritance

(g) Horn clauses and the closed world assumption
Translation to Prolog

4. Part IV: Planning (chapter 11)

   Project 2: solving a problem using an existing planner (as time permits)

   (a) Planning in the situation calculus

   (b) The Strips planning language

   (c) Partial-order planning

5. Part V: Machine Learning

   Assignment 4, and **Project 3**: solving a problem using decision-tree induction.

   (a) Bayes theorem and intuitions behind Bayesian nets (chapter 14, pp. 415-426)

   (b) Information theory and decision-tree induction (chapter 18, pp. 525-543).