1. **TITLE OF COURSE AND COURSE NUMBER:** Artificial Intelligence, CS410, Credits: 3, (Advanced Computer Science Elective for Major)

2. **DESCRIPTION OF THE COURSE:** A study of classical and modern approaches to artificial intelligence including knowledge representation, search strategies, inference systems, logic programming, list processing, machine learning, natural language processing, neural nets. Exercises in programming using current tools, COMMON LISP, or PROLOG.

3. **COURSE PREREQUISITES:** MATH 324 and CS 342 with a grade of C- or better

4. **COURSE OBJECTIVES:**
   - To present fundamental concepts of artificial intelligence, both theory and practice.
   - To familiarize student with the concepts of Artificial Intelligence programming and develop experience with COMMON LISP or PROLOG.
   - To develop problem-solving methodologies.
   - To look at directions in artificial intelligence research.

5. **STUDENT LEARNING OUTCOMES:**
   Upon completion of this course, students will be able to:
   a) Comprehend the concept of artificial intelligence from several perspectives, in terms of defining principles, philosophical issues, problem-solving model, and construction of programs with the characteristics formulated therein. Naturally, links to the historical context of scholarship and discovery will be instilled in the Socratic-dialog process. Measure: exams, surveys, and projects.
   b) Understand and express the fundamental results and problems in several sub-disciplines/domains of artificial intelligence (AI). Measure: exams and projects.
   c) Program in at least one AI language, either LISP or PROLOG. Student programs will need to meet several AI criteria (such as (but not limited to) adaptability to different situations, complex processing, or inference formulation). Measure: projects.
   d) Conduct intensive problem-solving and inquiry based efforts over several days to formulate proto-types of AI domain constructs, taking them to the large web-sites of the MIT AI Labs, CMU's AI Repository, and other established research sites. Measure: exams, surveys, and projects.
   e) Formulate alternate representations of knowledge leading to computer-based AI
processing. Each representation requires extensive practice, sometimes requiring student become capable of designing new models for data (like frames), creating alternate grammars (like case grammars), or even formulating alternate logics (like fuzzy logics or situation-temporal logic). In this sense, students will broaden their scope of mental capabilities and open them selves to higher planes of reasoning, not more thoughts but meta-thinking. Measure: exams, surveys, and projects.
f) Apply their background in calculus and probability & statistics (Math 324, a calculus based course) to formulate probabilistic models of intelligent systems such as expert systems, neural nets, and Bayesian inference systems. Their analytic knowledge will be directed to construct these key industrial tools for the next generation. Statistical decision-making evident in the "intelligent agents" on the internet become standard design tools in the student's "programming toolbox". Measure: exams, surveys, and projects.
g) Apply classical logic in AI contexts. After introduction to mechanized resolution-based inference and theorem proving, they will solve logic problems of progressively more complex natures. Measure: exams, surveys, and projects.
h) Through classroom participation in problem-solving sessions and discussions, homework, papers, and other assignments, this course also reinforces the following student learning outcomes in accordance with the university:
- Effectively express themselves in written and oral form Measure: exams and projects.
- Demonstrate the ability to think critically. Measure: exams, surveys, and projects.
- Locate and use information. Measure: projects.
- Demonstrate the ability to integrate knowledge and ideas in a coherent and meaningful manner Measure: exams and projects.

6. TOPICAL OUTLINE OF THE COURSE CONTENT:
1) Introduction
   a. What is AI?
   b. What are the Goals of AI?
2) Knowledge Representation
3) Searching
   a. Basic Search Strategies, Recursion, & Backtracking
   b. Breadth First vs. Depth First
   c. A*, Planning, MiniMax
   d. AND/OR Trees, Alpha-Beta Search
4) Deduction Systems
   a. Review of Propositional Calculus and Predicate Calculus
   b. Basic Systems of Inference
   c. Resolution Method
   d. Applications of Deduction Schemes
   e. Horn Clauses, Unification, PROLOG
5) LISP Programming
6) Advanced AI Techniques
a. Statistical Models of Reasoning
b. Machine Learning
c. Neural Net Models
d. Models of Graphic Pattern Analysis
e. Production Systems and Syntactic Schemes

7. GUIDELINES/SUGGESTIONS FOR TEACHING METHODS AND STUDENT LEARNING ACTIVITIES:

A. Classroom lectures, discussions, problem-solving sessions, homework reviews, and pre-exam reviews
B. Hands-on sessions in the computer room
C. Homework assignments

8. GUIDELINES/SUGGESTIONS FOR METHODS OF STUDENT ASSESSMENT (OUTCOMES):

A. Periodic examinations and final examination
B. Several programming projects
C. Term paper

9. SUGGESTED READINGS, TEXTS, OBJECTS OF STUDY:


Several handouts and on-line documents.

10. BIBLIOGRAPHY OF SUPPORTIVE TEXTS AND OTHER MATERIALS:


Charniak and Dermott [1985] "Introduction to Artificial Intelligence", Addison Wesley


Jackson [1977] "Introduction to Artificial Intelligence", Dover


Winston and Horn [1990] "LISP", 3rd edition, Addison Wesley

11. PREPARER'S NAME AND DATE: Dr. John Najarian

12. ORIGINAL DEPARTMENTAL APPROVAL DATE: Spring, 1996

13. REVISERS' NAME AND DATE: Dr. John Najarian, Spring 2005 and previously 4/1/2000

14. DEPARTMENTAL REVISION APPROVAL DATE: Spring 2005