LSC Use Only
Number: _____
Action: _____
Date: _____

UWUCC Use Only
Number: 8
Action: _____
Date: _____

CURRICULUM PROPOSAL COVER SHEET
University–Wide Undergraduate Curriculum Committee

I. Title/Author of Change

Course/Program Title: CO 405, Artificial Intelligence
Suggested 20 Character Course Title: Artificial Intell
Department: Computer Science
Contact Person: Mary Micco, x2637

II. If a course, is it being Proposed for:

x Course Revision/Approval Only
_____ Course Revision/Approval and Liberal Studies Approval
_____ Liberal Studies Approval Only (course previously has been approved by the University Senate)

III. Approvals

John A Cross
Department Curriculum Committee

Gary L Butterbaugh (Appr 3/21/90)
Department Chairperson

College Curriculum Committee

W J Cal
College Dean *

_____
Director of Liberal Studies (where applicable)

_____
Provost (where applicable)

*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. Timetable

Date Submitted to LSC: _____
to UWUCC: _____

Semester to be implemented: _____

Date to be published in Catalog: _____

INDIANA UNIVERSITY OF PENNSYLVANIA
SENATE CURRICULUM COMMITTEE

NEW COURSE PROPOSAL

CO 405 ARTIFICIAL INTELLIGENCE

Department: COMPUTER SCIENCE

Person to Contact for Further Information: MARY MICCO, X2637

Desired Effective Semester for Change: FALL, 1990

Date of Proposal: March 21, 1990

Approvals:

Department Committee Chairperson John A Cross

Department Chairperson Gary L Butenhoff

College Curriculum Committee _____

College Dean _____

DESCRIPTION OF CURRICULAR CHANGE

I. Catalog description - attached.

II. Course Objectives

A. Catalog Description - attached.

B. Course Objectives.

1. Students will know the history of artificial intelligence research.

2. Students will demonstrate an understanding of a variety of knowledge representation techniques.

3. Students will develop applications in three different artificial intelligence packages.

C. Detailed Course Outline.

1. What is Intelligence: Criteria for judging it (2 hours)

2. Description Matching and Goal Reduction (2 hours)

One procedure that does geometric analogy problems by description matching and another procedure that manipulates toy blocks by goal reduction will be presented. The purpose is to demonstrate the importance of good representation and to introduce some particularly useful problem-solving tools early on.

3. Exploiting Natural Constraints (3 hours)

Once essential facts are well described, constraints may emerge that make problem solving easy. This is true of problems in basic algebra, for example. One example will show how symbolic constraint propagation aids line-drawing analysis. This leads to an introduction to dependency-directed backtracking, by which compatible choices are found efficiently. We conclude with a discussion of the critical role of representation and constraints in Artificial Intelligence.

4. Exploring Alternatives (2 hours)

Sometimes there is no way to solve a problem without exploring some alternative routes to a solution. Useful examples are the problems involved in traversing various kinds of mazes, discovering new concepts, finding optimal ways of arranging inherently sequential tasks, and playing

games like checkers and chess.

5. Control Metaphors and the General Problem Solving Paradigms. Generate and Test Paradigm (2 hours)

Control concerns the process of passing information and attention around a computer problem-solver's collection of procedures. The focus here turns directly to the question of attention; and we consider, among other things, the General Problem Solver paradigm.

6. Problem-Solving Paradigm (2 hours)

There are a number of basic paradigms behind problem solvers. One is the generate-and-test paradigm. The DENDRAL system for mass spectrogram analysis is a generate-and-test system. Another problem-solving paradigm is the rule-based-system paradigm. XCON, a rule-based synthesis system, lays out computer-system components; MYCIN, a rule-based analysis, diagnoses infectious diseases.

7. Logic and Theorem Proving - truth values, rules of inference and techniques for proof; introduction to Prolog. (5 hours)

Logic involves truth values, rules of inference, and techniques for proof. We will look at two popular logic-oriented techniques: resolution theorem proving and truth maintenance. Along the way, we experience the problem of keeping knowledge up to date, popularly known as the frame problem. Finally, we concentrate on how computers can be made to know common sense things, to understand human language, to see the world, and to learn.

8. Representing Common Sense Knowledge as Heuristics (3 hours)

Powerful representation is an essential ingredient of intelligence. We begin by drawing a distinction between syntax and semantics. Thus equipped, we explore semantic nets, a popular mechanism for recording relations, and we encounter inheritance, defaults, demons, and perspectives. Next, we move on to representing story knowledge, dealing with frames and standard stereotypes. Finally, we show how primitive-act frames enable some story paraphrase recognition, and how abstraction units enable some story summarization.

9. Natural Language Understanding (6 hours)

For a computer to deal with written language, it is necessary to translate sentences into an internal description suited

to solving problems. This can require many representations such as parse trees, thematic-role frames, and various kinds of semantic structures. To get started, we examine context-free parsers, transition-net parsers, and wait-and-see parsers. Next, we consider the issues involved in building thematic-role frames. And finally, we think about transition-net semantic grammar systems for practical language interfaces such as INTELLECT and LIFER.

10. Vision and Image Understanding (4 hours)

Better representation is the key to computer understanding of visual images as well as to computer understanding of language. Among the popular representations are the primal sketch, the 2 1/2-D sketch, and the generalized-cylinder model, which makes things about volumes explicit. We start with edge finding and binocular stereo, describe how shading interacts with surface orientation, and finally, explain feature-space pattern-recognition systems for practical identification and location, mentioning CONSIGHT in particular.

11. Learning Class Descriptions from Samples. Machines that Learn. (4 hours)

Here we begin to look at learning, both computer and human. We start with an enumeration of various induction heuristics that enable learning about object classes. Next, we examine some specific procedures that use the induction heuristics, procedures that often perform better than people.

12. Intelligent Tutoring Systems. Machines that can Teach. (5 hours)

We see how to learn grammar rules by analyzing impasse-causing sentences, and we see how to learn rule-like principles by recognizing analogies between precedents and exercises, just as people do in learning about management, political science, economics, law, medicine, and life in general.

D. Evaluation Methods.

Assignments and Examinations

1. There are a series (6 to 8) of small assignments worth varying numbers of points. Together, these assignments account for about 300 points and provide experience in using PROLOG and an induction based Tool First Class, as well as frame-based package Personal Consultant.

2. a. There will be two (2) one hour tests at specified times during the semester as well as a final.

   b. The tests will consist of true/false, multiple choice and short answer questions and will be based on the readings assigned in the textbooks and articles. You are considered responsible for the assigned readings. There is no guarantee that everything will be covered in class.

   c. Make-up tests will be given only in special cases and only with previous permission.

3. Grading

   Grades will be determined as follows, based on total points:

   a. Tests 40%
   b. Projects 40%
   c. Homework, quizzes, and participation 20%

100 - 90 = A, 89 - 80 = B, 79 - 70 = C, 69 - 60 = D, < 60 = F

E. Required Textbook, Supplemental Books and Readings.

Winston, Patrick, Artificial Intelligence, Addison-Wesley, 1987, 2nd. ed.

F. Special Resource Requirements.

No additional costs for the student are anticipated.

G. Bibliography.

Charniak, Eugene & Drew McDermott. Introduction to Artificial Intelligence, Addison-Wesley Publishing Co., Reading, MA, 1986.

Feigenbaum, Edward A., Barr, Avron, and Cohen, Paul R. (eds.), The Handbook of Artificial Intelligence, Volume 1 - 3, HeurisTech Press/William Kaufmann, Inc., Stanford, CA, 1981-82.

Firebaugh, Morris W., Artificial Intelligence: A Knowledge-based Approach, Boyd & Fraser, Boston, MA, 1988.

Fischler, Martin A., & Oscar Firschein, Intelligence: The Eye, the Brain, and the Computer, Addison-Wesley Publishing Co., Reading, MA, 1987.

Schank, Roger C., Peter G. Childers, The Cognitive Computer: On Language, Learning and Artificial Intelligence, Addison-Wesley Publishing Co., Reading, MA, 1984.

III. Course Analysis Questionnaire.

A. Details of the Course

1. This course is designed to provide students with exposure to a whole group of problem solving techniques loosely classified as artificial intelligence. It explores a different class of programming languages.

   This course is designed as an upper-level course for our majors and minors. It will also be available for MIS majors who have taken the necessary prerequisites.

   It is not proposed for inclusion in the Liberal Studies course list.

2. This course does not require changes in the content of existing courses. It supplements and enriches the core courses by providing an added dimension.

3. This course follows the traditional teaching approach of the department. Within this format, students are challenged to explore two major questions: "What is intelligence?" and "Can we simulate intelligent behavior with machines?"

4. This course has been offered once to eighteen students as a Special Topics course. The enclosed syllabus and bibliography were used. In order to permit meaningful comparison of the various languages and problem solving techniques, students used one project for the entire semester and implemented solutions in the following ways:
   1. with PROLOG, a logic based approach,
   2. with an induction based tool called First Class, 3. with a frame-based tool called Personal Consultant.

5. This course could be dual-listed, but nothing has been done to accomplish this.

6. This is not a variable credit course.

7. This course is offered in most of the other SSHE institutions (Kutztown, Clarion, West Chester, Lockhaven, California) and in many other institutions of higher education. It is a standard offering in both the ACM and DPMA curriculums.

8. This material is not required in the ACM accreditation standards but it is suggested as an elective.

B. Interdisciplinary Implications

1. There will only be one instructor for this course.

2. It is not anticipated that any additional or corollary courses will be needed.

3. This course does not overlap with any other courses at the University.

4. If demand materializes, we will make seats available.

C. Implementation

1. Resources

a. No new faculty will be needed.
b. Current space is adequate.
c. Hardware is adequate. (Computer Science network, VAX mainframe, Microvax, NEXT, PC's)
d. Software is already in place. (7 copies of TurboProlog, Lisp on mainframe, Macsyma on NEXT, First Class and Personal Consultant on PC's)
e. We have requested some acquisitions to upgrade our library holdings.
f. No travel funds required.

2. Some grant funds have been used to purchase software and hardware.

3. This course will be offered at least once every two years usually in the Spring semester or as demand indicates.

4. One section will be offered at a time.

5. Twenty-five students will be accommodated in this course. The nature of the lab activities restricts enrollment to this number.

6. No guidelines were available as of this writing.

7. This course will not be a curriculum requirement.

D. Miscellaneous

None attached.

LETTERS OF SUPPORT

None attached.

CURRICULAR OFFERING/CHANGE AUTHORIZATION FORM

Attached.

CATALOG DESCRIPTION

CO405 Artificial Intelligence 3C-0L-3SH

Prerequisite: CO310 Data Structures

~~This course is meant to provide the students with~~ An introduction to the field of artificial intelligence, i.e., the study of ideas that enable computers to process data in a more intelligent way than conventional practice allows. The course covers many information-representation and information-processing techniques. Students will explore the underlying theory including matching, goal reduction, constraint exploration, search, control, problem solving and logic.