UNIVERSITY OF NEBRASKA AT OMAHA
COURSE SYLLABUS/DESCRIPTION

Department and Course Number	CSCI 4450
Course Title	Introduction to Artificial Intelligence
Course Coordinator	Raj Dasgupta
Total Credits	3
Date of Last Revision	May 14, 2015

1.0 Course Description

1.1 Overview of content and purpose of the course (Catalog description).
An introduction to artificial intelligence. The topics covered in this course include search algorithms (uninformed and informed), logical reasoning, reasoning under uncertainty with Bayesian networks, temporal reasoning, decision making and uncertainty and machine learning.

1.2 For whom course is intended.
The course is designed for computer science majors, and other students, who wish to gain a broad understanding of the foundations of artificial intelligence and the way in which machine intelligence is used to solve problems.

1.3 Prerequisites of the course (Courses).
CSCI 3320 Data Structures.

1.4 Prerequisites of the course (Topics).
- 1.4.1 Basic topics in programming;
- 1.4.2 Basic topics in data structures;
- 1.4.3 A reasonable degree of mathematical sophistication.

1.5 Unusual circumstances of the course.
None

2.0 Objectives

2.1 Understand the basic topics of artificial intelligence such as search algorithms, reasoning and inference using logic and uncertainty models, decision making under uncertainty machine learning, etc.
2.2 Understand the way in which machine intelligence are used to solve problems.
2.3 Realize the contemporary areas of research in field of artificial intelligence.

3.0 Content and Organization

Contact Hours

1. Introduction (1.5 hours)
2. Search
   2.1. Uninformed Search algorithms (3 hours)
      - 2.1.1. Breadth-first search
      - 2.1.2. Depth-first search
      - 2.1.3. Depth limited search

        2.1.4. Iterative deepening search
        2.1.5. Bidirectional search
    2.2. Informed Search Algorithms (4.5 hours)
        2.2.1. Greedy best first search
        2.2.2. A* search
        2.2.3. Hill-climbing search
        2.2.4. Simulated annealing and local beam search
        2.2.5. Genetic Algorithms
        2.2.6. Online search – LRTA* search
3. Knowledge and Reasoning (7.5 hours)
    3.1. Propositional Logic
    3.2. Inference using propositional logic
    3.3. First Order Logic
    3.4. Inference in First Order Logic
        3.4.1. Unification and Lifting
        3.4.2. Forward Chaining
        3.4.3. Backward Chaining
        3.4.4. Resolution
4. Uncertain Knowledge and Reasoning (9 hours)
    4.1. Probability review: Bayes Rule, conditional independence
    4.2. Bayesian Networks
    4.3. Inference using Bayesian networks
    4.4. Inference in Temporal Models
        4.4.1. Filtering, Prediction, Smoothing, Most-likelihood explanation
    4.5. Hidden Markov Models
    4.6. Kalman Filters
    4.7. Dynamic Bayesian networks
5. Learning Algorithms (4.5 hours)
    5.1. Decision Trees
    5.2. Ensemble Learning
    5.3. Maximum Likelihood and Naïve Bayes model
    5.4. Neural Networks
6. Decision Making under Uncertainty (4.5 hours)
    6.1. Ulitlity and decision networks
    6.2. Markov Decision Processes
        6.2.1. Value Iteration (1 lecture)
        6.2.2. Policy Iteration (1 lecture)
    6.3. Partially Observable Markov Decision Processes

    **: Will be covered if time permits

4.0 Teaching Methodology

4.1 Methods to be used.

The course will be presented primarily by lecture, with opportunities for discussion with and questions from the students.

4.2 Student role in the course.

Students will be expected to attend lectures, complete written and programming assignments, do a course-related project and take periodic examinations.

4.3 Contact hours.
Three hours per week.

5.0 Evaluation

5.1 Type of student projects that will be the basis for evaluating student performance, specifying distinction between undergraduate and graduate, if applicable. For Laboratory projects, specify the number of weeks spent on each project).

Evaluation will be based principally on written and programmed assignments, and periodic examinations.

5.2 Basis for determining the final grade (Course requirements and grading standards) specifying distinction between undergraduate and graduate, if applicable.

Components	Grading
Programming Assignment	30%
Project	25%
Intermediate Exams	20%
Final Exam	35%25%

5.3 Grading scale and criteria.
The following is the possible grading scale and criteria = accumulated grade points from 5.2:

Points	Grade
97-100%	A+
93-96%	A
90-92%	A-
87-89%	B+
83-86%	B
80-82%	B-
77-79%	C+
73-76%	C
70-72%	C-
67-69%	D+
63-66%	D
60-62%	D-

6.0 Resource Material

6.1 Textbooks and/or other required readings used in course.

6.1.1 S Russell and P. Norvig, "*Artificial intelligence*," Third Edition, Prentice Hall, 2009.

6.2 Other suggested reading materials, if any.

6.2.1 Books

6.2.1.1 D. Barber, "*Bayesian Reasoning and Machine Learning*," Cambridge Univerity Press, 2012.

6.2.1.2 K. Murphy, "*Machine Learning: A Probabilistic Perspective*," MIT Press, 2012.

6.2.1.3 G. Luger, "*Artificial Intelligence: Structures and Strategies for Complex Problem Solving*," Sixth Edition, Addison-Wesley, 2008.

6.2.1.4 N. Nillson, "*Artificial Intelligence: A New Synthesis*," Morgan Kaufmann, 1998.

6.2.1.5 J. Pearl, "Causality: Models, Inference and Reasoning," Second Edition, Cambridge Univesity Press, 2009.

6.2.2 Journals

6.2.2.1 Journal of Artificial Intelligence Research

6.2.2.2 Artificial Intelligence

6.2.2.3 AI Magazine

6.2.2.4 IEEE Transactions on Systems, Man, Cybernetics: Systems

6.2.2.5 ACM Transactions on Autonomous and Adaptive Systems

6.2.2.6 ACM Transactions on Intelligent Systems and Technology

6.3 Other sources of information.
None

6.4 Current bibliography of resource for student's information.
None

7.0 Computer Science Accreditation Board (CSAB) Category Content (class time in hours)

CSAB Category	*Core*	*Advanced*
Data structures	0	0
Computer organization and architecture	0	0
Algorithms and software design	3	12
Concepts of programming languages	0	0

8.0 Oral and Written Communications

Every student is required to submit at least __0___ written reports (not including exams, tests, quizzes, or commented programs) to typically _____ pages and to make ___0__ oral presentations of typically _____ minutes duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

9.0 Social and Ethical Issues

No coverage

10.0 Theoretical Content

		Contact hours
10.1	Problem solving using search algorithms	3.0
10.2	Semantic information processing	1.5
10.3	Theorem proving	1.5
10.4	Machine learning	3.0
10.5	Bayesian Inference	3.0
10.6	Perception	1.5

11.0 Problem analysis

Students will learn topics on problem analysis such as machine problem solving using search algorithms, machine learning, logical reasoning and Bayesian inference, etc.

12.0 Solution design

Students will apply artificial intelligence techniques in machine problem solving using search algorithms, machine learning, logical reasoning and Bayesian inference, etc.

CHANGE HISTORY

Date	***Change***	***By whom***	***Comments***
09/10/2002	Initial ABET version	Zhu	
06/13/2003	Cleanup	Wileman	
12/05/2008	Syllabus update	Dasgupta	Revised Section 3(content) and Section 6(resource material) to make them up to date, changes reviewed by Chen, Guo, Zhu
05/14/2015	Syllabus update	Dasgupta	Revised Section 1 (Course Description), Section 2 (Objectives). Added Partially Observable Markov Decision Processes under under Section 3 (Content and Organization). Added project as one of the componets for determining final grade in Sections 4 and 5. Updated books and journals in Section 6 (Resource Material)