Computer Science Department
cs.salemstate.edu

CSC 340 Artificial Intelligence **4 cr.**

Instructor: TBA **Office:** location **Phone:** (978) 542-extension
email: TBA@salemstate.edu **Office Hours:** days and times

Section	Time	Room	Final Exam
nn	days and times	location	date and time

Catalog description:

This course studies the theory and application techniques which allow a computer to "behave intelligently". Various operational definitions of intelligence are discussed, along with the concept of "mechanized intelligence". The course includes case studies of expert systems which solve engineering design problems, diagnose disease, and learn from their environment via natural language and/or visual interaction with a user. The role of planning, goal formation, search analysis and evaluation, and various forms of representation will be discussed extensively. Four lecture hours per week, plus programming work outside of class.

Prerequisites: **CSC 105 or CSC 215, and CSC 260.**

Goals:

This course is intended to introduce the basic concepts of artificial intelligence. The student will employ hands-on case studies to internalize the techniques of AI. The course will develop an understanding of:

CG01: the concepts of the fundamental branches of artificial intelligence;
CG02: the basic approaches to problem-solving using AI techniques;
CG03: knowledge representation and automated reasoning;
CG04: the concept of machine learning and its various technical issues.

Objectives:

Upon successful completion of this course the student will have

CO01: explained the rudimentary concepts of artificial intelligence techniques;
CO02: selected an artificial intelligence method of solution based on stated problem constraints;
CO03: mastered heuristic functions and search strategies such as uninformed search and informed search;
CO04: demonstrated knowledge of expert systems;
CO05: demonstrated knowledge of computer-based knowledge representation, reasoning, and planning;
CO06: demonstrated through projects and written assignments the ability to apply methods and techniques of machine learning (e.g. supervised learning, unsupervised learning, reinforcement learning, neural networks, genetic algorithms, and/or Bayesian Belief networks).

Program Outcome vs. Course Objectives matrix

Program Objective (condensed form)	CO01	CO02	CO03	CO04	CO05	CO06
PO-A: apply knowledge of computing and math	✓	✓	✓	✓	✓	✓
PO-B: analyze a problem and define its computing requirements		✓	✓		✓	✓
PO-C: design, implement and evaluate applications			✓			✓
PO-D: function effectively in teams to accomplish a common goal					✓	
PO-E: professional, ethical, and social responsibilities						

Program Objective (condensed form)	CO01	CO02	CO03	CO04	CO05	CO06
PO-F: communicate effectively with a range of audiences						
PO-G: local and global impact of computing on people and society						
PO-H: need for continuing professional development						
PO-I: use current techniques, skills, and tools			✓	✓	✓	✓
PO-J: apply theory and principles to model and design systems		✓	✓			✓
PO-K: apply design and development principles in constructing software						
note - full statements of the Program Outcomes (program objectives) for the Computer Science Major can be found in the document *Computer Science Major Program Educational Objectives and Program Outcomes* on the Assessment page of the Computer Science Major (cs.salemstate.edu)						

Topics:

- functional definitions of intelligence **IS1(5)**
- basic data representation and storage techniques
- defining bounds on a problem
- constraint propagation
- sovling problem by searching **IS2(5), IS4(2)**
  - solving problems by searching
  - classical approaches to search
  - search spaces, search trees, goal trees
  - uninformed search strategies
  - informed search strategies
  - heuristic functions
  - adversarial search and game playing
- planning
- general control paradigms using GPS as a starting point
- problem solving approaches
  - generate and test
  - rule based systems
- knowledge representation and reasoning **IS3(6)** IS5(3) (not core)
  - review of basic techniques
  - inheritance, slots, frames, semantic netslogic
  - propositional logic
  - first-order logic
  - inference and reasoning
  - knowledge-based agents
- expert systems
  - rules for knowledge representation
  - forward/backward chaining
  - rule-based expert systems
- machine learning IS6(1), IS8(6) (not core)
  - matching
  - rules and rule-like paradigms
  - learning by example
  - unsupervised learning
  - supervised learning
  - reinforcement learning
- application of preceding concepts (coverage dependent on time available) IS8 (2), IS7(1), IS9(3),IS10(6) (nc)

- language understanding
- neural networks
- Bayesian Belief networks
- genetic algorithms
- perception and vision analysis
- medical diagnosis
- mathematical theorem proving

Assignments and Examination:

The emphasis of this course in on the understanding of the basic approaches to knowledge acquisition, representation and retrieval with respect to the general concept of simulating intelligent behavior. Various techniques for representing knowledge and rules are presented and discussed with emphasis on generalized problem-solving paradigms. Specific examples of AI and AI-related systems are included as a means of solidifying theoretical concepts.

The course grade will be determined using the following approximate weights: final exam: 30%, written homework, and projects: 70%.

Course Objective / Assessment Mechanism matrix

	Homework	Projects	Final Examination
CO01	✓		✓
CO02	✓		✓
CO03	✓	✓	✓
CO04	✓	✓	✓
CO05	✓	✓	✓
CO06	✓	✓	✓

Bibliography:

Alpaydin, Ethem. **Introdciton to Machine Learning (Adaptive Computation and Machine Learning series). Second Edition**. The MIT Press, 2009.

Buckland, Mat. **Programming Game AI by Example**. Jones & Bartlett Publishers, 2004.

Cawsey, Alison. **The Essence of Artificial Intelligence**. Prentice Hall, 1997.

Coppin, Ben. **Artificial Intelligence Illuminated.** Jones & Bartlett, 2004.

Giarratano, Joseph C. **Expert Systems: Principles and Programming. Fourth Edition**. Course Technology, 2004.

Hall, J. Storrs. **Beyond AI: Creating the Conscience of the Machine**. Prometheus Books, 2007.

Jones, M. Tim. **Artificial Intelligence: A Systems Approach**. Jones and Bartlett publishers, 2008.

Jones, M. Tim. **AI Application Programming (Programming Series). Second Edition**. Charles River Media, 2005.

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

Millington, Ian; Funge, John. **Artificial Intelligence for Games. Second Edition**. Morgan Kaufmann, 2009.

Negnevitsky, Michael. **Artificial Intelligence: A Guide to Intelligent Systems**. **Second Edition.** Addison-Wesley, 2005.

Nillson, Nils. **The Quest for Artificial Intelligence**. Cambridge University Press, 2010.

Patterson, Dan W. **Introduction to Artificial Intelligence & Expert Systems**. Prentice Hall, 1990.

Russell, Stuart; Norvig, Peter. **Artificial Intelligence: A Modern Approach**. **Third Edition.** Prentice Hall, 2010.

Scientific American. **Understanding Artificial Intelligence (Science Made Accessible)**. Grand Central Publishing, 2002.

Schalkoff, Robert J. **Intelligent Systems: Principles, Paradigms and Pragmatics**. Jones & Bartlett, 2010.

Academic Integrity Statement:

"Salem State University assumes that all students come to the University with serious educational intent and expects them to be mature, responsible individuals who will exhibit high standards of honesty and personal conduct in their academic life. All forms of academic dishonesty are considered to be serious offences against the University community. The University will apply sanctions when student conduct interferes with the University primary responsibility of ensuring its educational objectives." Consult the University catalog for further details on Academic Integrity Regulations and, in particular, the University definition of academic dishonesty.

The Academic Integrity Policy and Regulations can be found in the University Catalog and on the University website (http://catalog.salemstate.edu/content.php?catoid=13&navoid=1295#Academic_Integrity). The formal regulations are extensive and detailed - familiarize yourself with them if you have not previously done so. A concise summary of and direct quote from the regulations: "Materials (written or otherwise) submitted to fulfill academic requirements must represent a student's own efforts". *Submission of other's work as one's own without proper attribution is in direct violation of the University's Policy* and will be dealt with according to the University's formal Procedures. *Copying without attribution is considered cheating in an academic environment - simply put,* ***do not do it!***

University-Declared Critical Emergency Statement:

In the event of a university-declared emergency, Salem State University reserves the right to alter this course plan. Students should refer to www.salemstate.edu for further information and updates. The course attendance policy stays in effect until there is a university-declared critical emergency.

In the event of an emergency, please refer to the alternative educational plans for this course, which will be distributed via standing class communication protocols. Students should review the plans and act accordingly. Any required material that may be necessary will have been previously distributed to students electronically or will be made available as needed via email and/or Internet access.

Equal Access Statement:

"Salem State University is committed to providing equal access to the educational experience for all students in compliance with Section 504 of The Rehabilitation Act and The Americans with Disabilities Act and to providing all reasonable academic accommodations, aids and adjustments. **Any student who has a documented disability requiring an accommodation, aid or adjustment should speak with the instructor immediately.** Students with Disabilities who have not previously done so should provide documentation to and schedule an appointment with the Office for Students with Disabilities and obtain appropriate services."

Note: This syllabus represents the intended structure of the course for the semester. If changes are necessary, students will be notified in writing and via email.