Global Learning Semesters
Course Syllabus
Course: COMP-616 Artificial Intelligence
Department: Computer Science
Host Institution: University of Nicosia, Nicosia, Cyprus

Course Summary		
Course Code	**Course Title**	**Recommended Credit Hours**
COMP-616	Artificial Intelligence	4
Semester Offered	**Contact Hours**	**Prerequisites**
Please contact us	42-45	Students are expected to have undergraduate-level knowledge of programming, Data Structures, Algorithms, Calculus and Discrete Mathematics. Basic knowledge of probability theory is an added advantage. Referring to the Computer Science undergraduate-level courses offered at Intercollege, the students are expected to have covered the syllabus of the following: COMP-301 Data Structures or COMP-516 Data Structures and Algorithms, COMP-255 C++ Language Programming or COMP-511 Initial Programming, MATH-190 Calculus and Analytic Geometry and MATH-340 Discrete Mathematics or COMP-513 Mathematics for Computer Science.
Department	**Level of Course**	**Language of Instruction**
Computer Science	Upper Division	English

Course Description

This course is designed for graduate students pursuing a Master's degree in Computer Science. The aim of this course is to provide a critical study of theory and research related to advanced topic areas of artificial intelligence. Topic areas include uncertain reasoning and in particular Bayesian networks and evidence propagation algorithms, learning, neural networks, computer vision, image understanding and speech recognition.

Prerequisites

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Topic Areas

1. Problem-solving by searching. Informed search methods.
2. Knowledge and Reasoning. First-order Logic.
3. Uncertain knowledge and reasoning.
    - Bayesian Networks
    - Bayesian Updating (Bayes rule, inference, independence assumptions)

- Propagation in Polytrees
- Approaches to Propagation in Graphs with Loops: Stochastic Simulation, Cutset Conditioning, Clustering, Propagation in Tree of Cliques
- Dempster-Shafer Theory of Evidence. Fuzzy Logic.

4. Neural Networks: Perceptrons, Multilayer networks, Backrpropagation algorithm.
5. Machine Learning. Entropy, learning in Neural and Bayesian Networks.
6. Computer Vision.
    - Image Processing
    - Extracting 3D-information. (Motion, binocular stereopsis, texture, shading).
    - Object Representation and Recognition.
    - Image Understanding.
7. Speech Recognition. Speech Recognition model, Hidden Markov Models.
8. Current research in Intelligent Internet Systems

Course Assessment

Students will be assessed through a series of weekly assignments, project work, a midterm and a final exam. The percentages contributing to the final grade are as follows:

Weekly Assignments:	10%
Project Work:	20%
Midterm Exam:	20%
Final Exam:	50%

Description of course assessment:

Weekly assignments: These will consist of non-programming questions/exercises based on the chapter covered during that week.

Project work: These will be small projects with a 2-3-week deadline or term projects. They will usually involve programming.

Some examples:

1) Implement the A* search algorithm in C (or C++), that solves the 8-puzzle using two different heuristics. Compare the performance of each one.
2) Design a Bayesian network for a particular problem. Quantify the network by giving conditional probability tables. Use Pearl's propagation algorithm to derive (by hand) the posterior probabilities of all variables given certain evidence.

3) (Term-project) Implement the Bayesian network in C (or C++). Test and evaluate the performance of your resulting system. Compare this approach to other approaches of uncertain reasoning.

4) Given a sequence of positive a negative training examples, provide a hand-trace of the Candidate. Elimination algorithm. Implement the algorithm and verify that it successfully produces the trace.

Midterm exam: It will contain the material covered up to the time of the midterm.
Final Examination: This examination will be comprehensive and it will include all the material covered throughout the semester.

Readings and Resources

Required Textbook

- Russel, S. and Norvig, P., Artificial Intelligence A Modern Approach, second edition, 2003, Prentice Hall. (Main textbook).

- Pearl, J., Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference, 1991, revised second edition, Morgan Kaufmann.
- Nilsson, N., Artificial Intelligence: A New Synthesis, 1998, Morgan Kaufmann.
- Mitchel T., Machine Learning, 1997, McGraw-Hill.
- Jain, R., Kasturi, R. and Schunk B. G., Machine Vision, 1995, McGraw-Hill.