Program and Course Code	Computing & Information Science CIS504
Course Title	Techniques in Artificial Intelligence
Credit Hours	3
Instructor	Iyad Rahwan
Contact Information	Email : irahwan [at] masdar.ac.ae Tel. +971 2 810 9134
Office Hours	TBA
Bulletin Course Description	This course is a graduate-level introduction to the field of artificial intelligence (AI). It aims to give students a solid understanding of the main abstractions and reasoning techniques used in AI. Topics include: representation and inference in first-order logic; modern deterministic and decision-theoretic planning techniques; basic supervised learning methods; and Bayesian network inference and learning.
Pre-requisites	Background in computer programming, undergraduate algorithms and data structures, and basic discrete mathematics and probability theory.
Co-requisites	None
Course Objectives (Learning Outcomes of the Course)	Subject-specific skills: By the end of this course, the student must be able to: o Use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent. o Use different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification. o Understand the conceptual and computational trade-offs between the expressiveness of different formal representations. Transferable skills: Upon completion, students will be able to: o Use key logic-based techniques in a variety of research settings; o communicate scientific knowledge at different levels of abstraction.

Week	Course Topics and Contents
1	Revision of search algorithms, and introduction to A* search
2	Propositional logic: syntax, semantics, and inference by resolution
3	First order logic: syntax, semantics and inference
4	Constraint Satisfaction Problems (CSP) and their solutions

5	Automated planning
6	Partial-order planning, and the Graph Plan algorithm
7	Representing uncertainty
8	Mid-semester break
9	Bayesian network inference (including variable elimination)
10	Hidden Markov Models
11	Utility and decision theory
12	Markov Decision Processes (MDP)
13	Partially Observable Markov Decision Processes (POMDP)
14	Reinforcement learning
15	Selected topics
16	Final Exam

Relationship of course objectives to program outcomes	
Program Outcome 1	Use and apply current technical concepts and practices in core computing and information technologies.
Program Outcome 2	Analyze a problem, and identify and define the computing requirements appropriate to its solution.
Program Outcome 3	Design, implement, and evaluate computer-based systems, processes, components, and programs both in teams and individually to meet desired outcomes.

Out-of-class assignments	
Homework	

Course Grading	
A mid-term exam	20 %
A final exam	30 %
Two take-home project assignments	25 % each
Total	100 %

Assignment	**Handed**	**Due**	**Topic**
1	Week 4	Week 10	Programming and applying search
2	Week 6	Week 15	Programming for learning and uncertainty

Class/Laboratory schedule and Methodology	
Class	The class meets 15 weeks, 2 lectures per

	week, 90 minutes each.
Laboratory	
Teaching and learning methodologies	A combination of white board use, Power-point slide presentation, and interactive class discussions to encourage student participation and enhance the learning.

Course Materials	
Textbooks	S. Russell and P. Norvig. *Artificial Intelligence: A Modern Approach.* Prentice Hall, 3rd edition, 2009 D. Poole and A. Mackworth. *Artificial Intelligence: Foundations of Computational Agents*, Cambridge University Press, 2010 Available online: http://artint.info/
Recommended Readings	• R. Brachman, H. Levesque. *Knowledge Representation and Reasoning*, Morgan Kaufmann, 2004. • G. Luger. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. Addison Wesley; 6 edition, 2008 • E. Alpaydin. *Introduction to Machine Learning*. MIT Press, 2nd edition, 2010 • R. S. Sutton and A. G. Barto. *Reinforcement Learning: An Introduction*. MIT Press, 1998
Instructional material and resources	