



Zarqa University
Faculty Information Technology
Department: Computer Science
Course title: Artificial Intelligence

Instructor:
Lecture's time:
Semester:
Office Hours:

Course description:

This course presents an introduction to the essential concepts and techniques of AI and its applications. The course focuses on the major sub-disciplines of AI such as: search strategies, constraint satisfaction, knowledge representation, inference mechanisms, automated reasoning and problem solving techniques. Other topics are introduced such as Expert Systems, Intelligent Agents, Prolog and natural language processing.

Aims of the course:

The main goal of this course is to give the students a practical and a theoretical overview of the AI technology and its fields through acquiring Conceptual Knowledge about Complex Problem Solving techniques and programming in logic. For achieving this goal there are intermediate objectives, which have to be reached during the different phases of the course. These sub objectives can be summarized as follows:

- AI Fundamental issues & Applications: The difference between AI Approaches and Traditional Approaches, Features of AI, Turing Test, principles of Artificial Intelligence, Heuristics, Introduction to Knowledge Representation and problem solving, introduction to AI Application areas.
- Search and Constraint Satisfaction: State Space representation and its components, Uninformed search, Combinatorial explosion, Heuristic search, Characteristics of heuristic function, finding the optimal solution, Game Search, utilizing backtracking for Solving a Constraint satisfaction Problem
- Knowledge Representation and reasoning: represent knowledge using logical Formulas and propositional logic, how to utilize resolution and unification as theorem proving method, shortcoming of two valued logic, basic principles of model theory, Search, Backtracking in PROLOG and Backward Chaining and Theorem Proving in PROLOG
- Advanced knowledge and Representation Reasoning under Uncertainty: how express uncertain knowledge using probability theory, Bayes Theorem, shortcoming of probability theory based knowledge representation and reasoning, Fuzzy Logic for representation of Imprecise and/or Uncertain knowledge. Fuzzy Logic for representation of Imprecise and/or Uncertain knowledge.
- AI Planning Systems: the basic concepts of a planning system, the distinction between problem solving as a search problem and planning system, planning in robotics.
- Natural Language Processing: role of knowledge Representation in a Natural Language Understanding Systems, syntax checkers based on different type of grammars, use PROLOG as a tool for programming a NLP system based on examples for Arabic.
- Intelligent Agents: architecture of an agent, agents that are capable of keeping track with their environments, the applications of the agent approach.



Intended Learning Outcomes (ILOs):

A. Knowledge and Understanding

- A1. Identify the different Application areas of AI
- A2. Understand the concept of problem solving as search, and learn how to use the various and Heuristic Search Techniques.
- A3. Understand the concepts and methodologies of Knowledge Representation.
- A4. Understand the basics of AI areas including Expert Systems, Case-Based and Model-Based Reasoning, Natural Language Processing, Neural Networks, Intelligent Agents, and Machine Learning.

B. Subject-specific skills

- B1. Analyze, compare and criticize the different search techniques
- B2. Synthesize modified search algorithms from existing ones.
- B3. Contrast the main approaches to AI: symbolic (logic, semantic nets, rules) vs. emergent (connectionist, genetic)
- B4. Analyze and compare inference mechanisms.

C. Critical-Thinking Skills

- C1. Solve a problem requiring a suitable knowledge representation and a search method
- C2. Learn the essentials of the Prolog Programming Language and experiment with an expert system shell
- C3. Write a report on a selected AI area

D. General and Transferable Skills (other skills relevant to employability and personal development)

- D1. *Communication*: Express and communicate ideas in written and oral forms.
- D2. *Teamwork and Leadership*: Be cooperative members of a team.
- D3. *Organizational and Developmental Skills*: plan, prioritize, and achieve defined goals.
- D4. *Ethical and Social Responsibility*: Understand that they are accountable for their actions and there must be a balance between economic growth and the welfare of the society and environment.

Course Structure:

Week	Hours	ILOs	Topics	Teaching Procedure	Assessment methods
1 st and 2 nd week	6	A1, A2, A3, A4,	Introduction What is Artificial Intelligence (AI)?, Brief history of AI, Applications of AI, Agents and environments, PEAS Agent types	T: Lecture & Discussion L: Reading lecture notes, Reading Chapter 1-3	Exams In class questions Quiz-1
3 rd to 4 th week	9	A1, B1, B2, C1, C2, D4	Searching Uninformed Searching, Informed searching , Genetic Algorithms	T: Lecture & Presentation L: Reading Chapter 4	Exams Assignment 1



5 th to 6 th week	9	A1, B2, B3, C1, D1, D2, D4	Games Mainly games of strategy such as: Sequence of moves to play, Rules that specify possible move sand Objective is to maximize your payment	T: Lecture & Presentation L: Reading Chapter 4	Exams Class Participation
7 th to 8 th week	9	A1, B2, B3, C1, C2, C3, D4	Constraint Satisfaction Techniques for solving very complex problems	T: Lecture & Presentation L: Reading Chapter 4	Exams Quiz-2
9 th and 11 th week	6	A1, B1, B2, B3, C1, C2, C3	First Order Logic Applying inference rules, Resolution and Forward chaining	T: Lecture & Presentation L: Reading Chapter 7-8	Exams Class Participation
12 th and 13 th week	3	B2, B3, C1, C2, D3, D4	Logic and PROLOG Logical Consequence Resolution Principle Resolution Refutation Principle Substitution Unification Resolution and Theorem Proving, Introduction to PROLOG	T: Lecture & Presentation L: Reading Chapter 7	Exams Assignment 2
14 th week		B2, B4, C2, D1, D2, D4	Natural Language Understanding Explicit formal specifications of the terms in the domain and relations among them	T: Lecture & Presentation L: Chapter 14	Exams

References:

A. Main Textbook:

1. Artificial Intelligence A Modern Approach Stuart Russel and Peter Norvig, Prentice Hall, 2nd ed. 2003

B. Supplementary Textbook(s):

2. Artificial Intelligence A Guide to Intelligent Systems M. Negnevitsky, Addison Wesley; 2 edition 2004

3. Artificial Intelligence: Theory and Practice Thomas Dean, Addison Wesley; 1st edition (May 10, 2002)



4. Artificial Intelligence, 3th Edition) Patrick Henry Winston, Addison Wesley; 3 edition (January 15, 1992)
5. PROLOG Programming Language For Artificial Intelligence Ivan Bartko, Addison Wesley; 4 edition (13 Nov 2008)
6. Artificial Intelligence, Nils J. Nilsson Morgan Kaufmann Publishers (1998)
7. Lecturer's Notes

Assessment Methods:

Methods	Grade	Date
First Exam	20%	
Second Exam	20%	
Assignments (Reports /Quizzes/ Class Participation)	10%	
Final Examination	50%	

Teaching and Learning Methods:

Interactive lectures (ILOs: A1, A2, A3, A4)

Lecture on major concepts and issues: Interactive lectures with videos and PowerPoint slides are conducted with lecturer explaining and illustrating the concepts. Students will be invited to share their view and experience in applying the concepts.

Group Projects and Presentations (ILOs: B1, B2, B3, C1, C2, C3, D1, D2, D3, D4)

Students will work on a course projects (2 to 3 students in a group). Each group will submit a short proposal of their project, including the names of team members starting from the second week of classes. Once the project is approved by the instructor, the group submits a more extended proposal which includes the role of each team member, Time-Plan, and the tools and applications that will be employed in the project. Each group will submit their project with a presentation at the end of the semester.

Online search / research and short presentations (ILOs: C2 , C3, D1, D3)

Each student will be required to search the net for a new topic that relates to this course. A one page summary of this topic is to be submitted a long with a 10 minute presentation.

Textbook Problems (ILOs: A1, A2, A3)

Problems have been selected for in-class illustration of certain concepts and applications. Additional textbook problems have been assigned for students to practice and gain better understanding of the concepts discussed. Homework assignments will be collected for grading.

Outside-classroom activities (ILOs: B3, C1 ,D2, D4)



Students are required to schedule meetings with their groups, and to document the results of such meetings.

AI Lab (ILOs: C1, C2, C3)

Students are required to visit the lab and to experiment with Java and PROLOG

COURSE POLICIES

The University Regulations on academic dishonesty will be strictly enforced! Please check the University Statement on plagiarism .

Make-up Exams: Only students with valid excuses are allowed to have make up exams. All excuses must be signed by the Faculty Dean. Student has the responsibility to arrange with his/her instructor for an exam date before the occurrence of the next regular exam .

All assignment and class work must be submitted at the specified due date. No late work will be accepted. Attendance policy will be strictly enforced (refer to student's Handbook)

No make up for quizzes under any circumstance .

