



Lahore University of Management Sciences
CS331 – Introduction to Artificial intelligence
Spring 2024

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| Instructor(s) | Mian Muhammad Awais, Muhammad Tahir |
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| Secretary/TA | TBA |
| TA Office Hours | TBA |
| Course URL (if any) | https://lms.lums.edu.pk/ |

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|---------------------------|------------------------|---|----------|------------|
| Course Basics | | | | |
| Credit Hours | 3 | | | |
| Lecture(s) | Nbr of Lec(s) Per Week | 2 | Duration | 75 minutes |
| Recitation/Lab (per week) | Nbr of Lec(s) Per Week | - | Duration | - |

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| Course Distribution | |
| Core | Yes |
| Elective | -- |
| Open for Student Category | CS Undergraduates |
| Close for Student Category | -- |

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| COURSE DESCRIPTION |
| <p>This is a fundamental course which builds basic understanding of different AI based systems relying on prerequisite knowledge of good programming skills, basic data structures, algorithms, and some university level mathematics. The course has been divided into different modules which constitute the design of underlying intelligent computer-systems. They mainly include: <u>Games and Search</u>, <u>Reasoning under uncertainty</u>, and <u>Machine Learning</u>. In each of these parts, the focus will be on formulating and solving the underlying problems by introducing different algorithms for the said purpose. As in example, in Games and Search, we will focus on how to formulate a problem as a graph and apply search algorithms to solve it.</p> |

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| COURSE PREREQUISITE(S) | |
| | <ul style="list-style-type: none">CS100 |
| Grading Breakup and Policy | |
| <p>Homework Assignments : 10%</p> <p>Quizzes: 20%</p> <p>Projects: 20%</p> <p>Midterm Examination: 20%</p> <p>Final Examination: 30%</p> | |

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| Examination Details | |
| Midterm Exam | <p>Yes/No: Yes</p> <p>Combine Separate: Combined</p> <p>Duration: 2 hours</p> <p>Preferred Date: During the Midweek</p> <p>Exam Specifications: In-person</p> |
| Final Exam | <p>Yes/No: Yes</p> <p>Combine Separate: Combined</p> <p>Duration: 3 hours</p> <p>Exam Specifications: In-person</p> |



Lahore University of Management Sciences

| Course Learning Outcomes | | | | |
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| | By the end of the course, the students should be able to | | | |
| CLO1 | <ul style="list-style-type: none">Understand key components in the field of artificial intelligenceUnderstand and implement classical artificial intelligence techniquesAnalyze artificial intelligence techniques for practical problem solving | | | |
| CLO2 | | | | |
| CLO3 | | | | |
| Relation to Program Learning Outcomes | | | | |
| CS331 CLOs | Related PLOs | Level of Learning | Teaching Methods | CLO Attainment checked in |
| CLO1 | PLO1: Academic Education | Cog-2 | Instruction, Homework | Midterm, Final |
| CLO2 | PLO2: Knowledge for Solving Computing Problems | Cog-3 | Instruction, Homework | Midterm, Final |
| CLO3 | PLO2: Knowledge for Solving Computing Problems | Cog-4 | Instruction, Homework | Midterm, Final |

| Textbook(s)/Supplementary Readings |
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| Textbook: <ul style="list-style-type: none"> Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, 4th Edition Reference Books: <ul style="list-style-type: none"> A First Course in Machine Learning by Simon Rogers and Mark Girolami, 2nd Edition |

| COURSE TOPICS | | | |
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| Week | | Topics | Assessment |
| 1 | Problem Solving: Search and Games | <ul style="list-style-type: none">Intro to AI, Agents + Environment + IntelligenceProblem solving using search: Uninformed search | Homework 1 Project 1 |
| 2 | | <ul style="list-style-type: none">Informed (heuristic) searchLocal searchConstraint satisfaction problems (CSP): CSP solvers | |
| 3 | | <ul style="list-style-type: none">CSP solvers (contd.)Adversarial search and games | |
| 4 | | <ul style="list-style-type: none">Minimax, alpha-beta, expectimaxMonte-Carlo tree search and chance | |
| 5 | Machine Learning | <ul style="list-style-type: none">Learning from examples, supervised learningLearning theory, Model selection and Optimization | Homework 2, 3 Project 2, 3 |
| 6 | | <ul style="list-style-type: none">Decision treesLinear regression and classificationLearning probabilistic models | |
| 7-8 | | <ul style="list-style-type: none">Neural Nets: From perceptron learning to deep learning | |
| Midterm Exam | | | |
| 9 | Uncertain knowledge and reasoning | <ul style="list-style-type: none">Probability, Independence and inferenceBayes Nets: representation, semantics and inference | Homework 4, 5 Project 4 |
| 10 | | <ul style="list-style-type: none">Bayes Nets: representation, semantics and inference (contd.)Probabilistic reasoning over time | |
| 11 | | <ul style="list-style-type: none">Making simple decisions | |
| 12 | | <ul style="list-style-type: none">Sequential decision problems and MDPs | |
| 13 | | <ul style="list-style-type: none">Reinforcement learning with applications in robotics | |
| 14 | Knowledge and Reasoning | <ul style="list-style-type: none">Logical agents, FOL and inference in FOL | |
| Final Exam | | | |



Lahore University of Management Sciences

Academic Honesty

The principles of truth and honesty are recognized as fundamental to a community of teachers and students. This means that all academic work will be done by the student to whom it is assigned without unauthorized aid of any kind. Plagiarism, cheating and other forms of academic dishonesty are prohibited. Any instances of academic dishonesty in this course (intentional or unintentional) will be dealt with swiftly and severely. Potential penalties include receiving a failing grade on the assignment in question or in the course overall. For further information, students should make themselves familiar with the relevant section of the LUMS student handbook.

Harassment Policy

SSE, LUMS and particularly this class, is a harassment free zone. There is absolutely zero tolerance for any behavior that is intended, or has the expected result of making anyone uncomfortable and negatively impacts the class environment, or any individual's ability to work to the best of their potential.

In case a differently-abled student requires accommodations for fully participating in the course, students are advised to contact the instructor so that they can be facilitated accordingly.

If you think that you may be a victim of harassment, or if you have observed any harassment occurring in the purview of this class, please reach out and speak to me. If you are a victim, I strongly encourage you to reach out to the Office of Accessibility and Inclusion at oi@lums.edu.pk or the sexual harassment inquiry committee at harassment@lums.edu.pk for any queries, clarifications, or advice. You may choose to file an informal or a formal complaint to put an end of offending behavior. You can find more details regarding the LUMS sexual harassment policy [here](#).

To file a complaint, please write to harassment@lums.edu.pk.

SSE Council on Equity and Belonging

In addition to LUMS resources, SSE's **Council on Belonging and Equity** is committed to devising ways to provide a safe, inclusive and respectful learning environment for students, faculty and staff. To seek counsel related to any issues, please feel free to approach either a member of the council or email at cbe.sse@lums.edu.pk

Rights and Code of Conduct for Online Teaching

A misuse of online modes of communication is unacceptable. TAs and Faculty will seek consent before the recording of live online lectures or tutorials. Please ensure if you do not wish to be recorded during a session to inform the faculty member. Please also ensure that you prioritize formal means of communication (email, LMS) over informal means to communicate with course staff.