Lingnan University

Department of Computing and Decision Sciences

Course Syllabus

Course Title	:	Introduction to Artificial Intelligence
Course Code	:	CDS2002
Recommended Study Year	:	2
No. of Credits/Term	:	3
Mode of Tuition	:	Sectional Approach
Class Contact Hours	:	3 hours per week
Category in Major Prog.	:	Required
Prerequisite(s)	:	CDS1001 Introduction to Programming for Data Science
Prerequisite(s)	:	Nil
Co-requisite	:	Nil
Exclusion	:	Nil
Exemption Requirement	:	Nil

Brief Course Description:

Artificial intelligence is the study of intelligent agents. Due to the continued success of applying artificial intelligence to different challenging problems requiring high-level intelligence, there is an explosive interest in this field for scientists, dreamers, entrepreneurs and educators. This course is designed for students to understand and appreciate the basic principles of artificial intelligence. It covers computational intelligent systems, which can support decision making, interact with humans, navigate vehicles and achieve many other interesting and useful tasks. These intelligent systems are extremely useful in business, science, the humanities and other fields.

Aims:

The course is designed to educate students to appreciate different types of intelligent agents, understand various AI techniques, and develop intelligent system in order to solve different some real-world problems. This course aims to provide basic concepts and techniques of artificial intelligence, an overview of intelligent agents, such as problem-solving, knowledge representation, reasoning, and some emerging computational intelligent approaches. It includes topics about logic, inference, genetic algorithms, swarm intelligence, and expert systems and generative AI. Applications from game playing, business, and other areas are selected to illustrate the concepts.

Learning Outcomes (LOs):

Upon the successful completion of this course, the student will be able to:

1. Identify and describe different types of intelligent agents;
2. Identify the characteristics and effectiveness of AI algorithms (PLO5);
3. Apply and compare different knowledge representations under different scenarios;
4. Formulate problems creatively as AI problems (PLO4);
5. Develop intelligent system to solve some sophisticated real-world problems (PLO9).

Indicative Contents:

Artificial Intelligence and Intelligent Agents
Test of the existing intelligence, such as Turing test
Agents, environment and the structure of agents

Problem Solving by Searching
Problem-solving agents, the concept of state space, uninformed search strategies, heuristic search and A* algorithm, local search algorithms, searching with partial observations

Adversarial Search
Optimal decisions in games, Alpha-Beta pruning, stochastic games, partially observable games, game programs

Constraint Satisfaction Problems
Definition of Constraint Satisfaction Problems (CSPs), constraint propagation, local search for CSPs

Knowledge Representations and Reasoning
Propositional logic, propositional theorem proving, agents based on propositional logic, first-order logic, forward chaining, backward chaining, expert systems, probabilistic knowledge representation and probabilistic reasoning

Advanced Topics in Artificial Intelligence
Swarm intelligence, genetic algorithms, connectionist system, fuzzy logic, generative AI

Teaching Method:

There are a number of teaching and learning activities including lectures, laboratories, group projects, and presentations. The concepts and principles of intelligent agents, AI algorithms, knowledge representations, reasoning, evolutionary computation and generative AI will be covered in lectures. Artificial intelligent software packages such as JESS, CLIPS, EXSYS, or JLog will be taught during the laboratories. Students are required to perform a group project to apply the concepts and principles covered in this course to analyse real-world problem(s) and formulate them as AI problem(s). Students will develop and apply intelligent system (s) to solve the AI problem(s). They are required to present their analyses, formulations and implementation of their intelligent system.

Measurement of Learning Outcomes:

	Class Attendance and Participation	Assignments	Group Project	Final Examination
1. Identify and describe different types of intelligent agents	x			x
2. Identify the characteristics and effectiveness of AI algorithms	x	x		x
3. Apply and compare different knowledge representations under different scenarios	x	x		x
4. Formulate problems creatively as AI problems			x	
5. Develop intelligent system to solve some sophisticated real-world problems			x	

1. There are a number of classroom activities to evaluate if the students can recognize the basic concepts of different intelligent agents and AI algorithms. Students are expected to demonstrate their understandings of different ways and means of representing knowledge in intelligent agents. (LO1-3 and PLO5)
2. The assignments require students to employ the right knowledge representation and develop some AI algorithms covered in the course. Students are expected to understand the characteristics and effectiveness of their implementations of the AI algorithms (LO2, LO3, and PLO5).
3. The Group Project requires students to create and use intelligent system for handling real-world problem(s). Students have to analyse their problem(s) thoroughly and then creatively formulate the given problem(s) as AI problem(s) (LO4-5, PLO4, PLO9).
4. The Group Project presentation measures student's presentation skills by requiring each student group to present their projects orally as well as answering questions from audiences. The Group Project and presentation are assessed for logicality, strength of arguments and feasibility of recommendations (LO4-5, PLO4, PLO9).
5. Comprehensive understanding of different types of intelligent systems, AI algorithms, and knowledge representations is assessed in the examination(s) (LO1-3 and PLO5).

Assessment:

Class Attendance and Participation	10%
Assignments	30%
Group Project	20%
Examination	40%
Total	100%

Required/Essential Readings:

1. Russell, Stuart J., and Norvig, Peter. *Artificial Intelligence : A Modern Approach*. 3rd Edition. Prentice Hall Series in Artificial Intelligence. Upper Saddle River, N.J.: Prentice Hall, 2010.

Recommended/Supplementary Readings:

1. Friedman-Hill, Ernest. *Jess in Action: Java Rule-Based Systems*. Manning Publications, 200
2. Giarratano, Joseph and Riley, Gary. *Expert Systems: Principles and Programming.* 4th Edition. Course Technology, 2004.
3. Genesereth, Michael and Nilsson, Nils. *Logical Foundations of Artificial Intelligence*. Morgan Kaufmann, 1987.
4. Joshi, Prateek. *Artificial Intelligence with Python*. Packt Publishing, 2017.
5. Poole, David L., and Mackworth, Alan K. *Artificial Intelligence: Foundations of Computational Agents*. 2nd Edition. Cambridge University Press, 2017.
6. Joseph Babcock and Raghav Bali. *Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models.* Packt Publishing, 2021

Important Notes:

(1) Students are expected to spend a total of 9 hours (i.e. 3 hours of class contact and 6 hours of personal study) per week to achieve the course learning outcomes.

(2) Students shall be aware of the University regulations about dishonest practice in course work, tests and examinations, and the possible consequences as stipulated in the Regulations Governing University Examinations. In particular, plagiarism, being a kind of dishonest practice, is "the presentation of another person's work without proper acknowledgement of the source, including exact phrases, or summarised ideas, or even footnotes/citations, whether protected by copyright or not, as the student's own work". Students are required to strictly follow university regulations governing academic integrity and honesty.

(3) Students are required to submit writing assignment(s) using Turnitin.

(4) To enhance students' understanding of plagiarism, a mini-course "Online Tutorial on Plagiarism Awareness" is available on https://pla.ln.edu.hk/.

Rubric for Examination(s) of CDS2002 - Introduction to Artificial Intelligence

Criteria	Very good (4-6)	Satisfactory (2-4)	Unsatisfactory (0-2)
Identify different types of intelligent agents (LO1)	The student can correctly identify most intelligent agents. Explanations have been given and most of them are correct.	The student can correctly identify some or most intelligent agents. Explanations have been given but some of them are incorrect.	The student can correctly identify very few intelligent agents. Explanations have not been provided or the explanations are basically incorrect.
Describe different types of intelligent agents (LO1)	Nearly all types of intelligent agents can be described correctly.	The student can describe some or most types of intelligent agents correctly.	The student can only describe very few types of intelligent agents correctly.
Recognize the characteristics of AI algorithms (LO2)	The characteristics of different AI algorithms can be elaborated correctly and clearly.	The characteristics of different AI algorithms can be described. But some of the descriptions are imprecise or have some mistakes.	The characteristics of different AI algorithms cannot be described, or the descriptions are basically incorrect.
The dynamic characteristics of AI algorithms (LO2)	The student can illustrate the dynamic characteristics of AI algorithms correctly.	The student can illustrate the dynamic characteristics of AI algorithms. But the illustrations have some mistakes.	The student cannot illustrate the dynamic characteristics of AI algorithms, or the illustrations are basically incorrect.
Describe the effectiveness of AI algorithms (LO2)	The effectiveness of different AI algorithms can be elaborated correctly and clearly.	The effectiveness of different AI algorithms can be described. But some of the descriptions are imprecise or have some mistakes.	The effectiveness of different AI algorithms cannot be described, or the descriptions are basically incorrect.
Apply different knowledge representations under different scenarios (LO3)	The right knowledge representations are employed for different problems. Explanations are provided and they are completely correct and precise.	The right knowledge representations are employed for some of the problems. Explanations are provided but some of them are not completely correct.	The right knowledge representations are employed for very few of the problems. Explanations are not provided, or they are basically incorrect.
Compare different knowledge representations under different scenarios (LO3)	The differences among various knowledge representations are elaborated correctly and precisely.	The differences among various knowledge representations are explainedbut the explanations have some minor errors.	The differences among various knowledge representations are not clear, or the descriptions are basically incorrect.

Rubric for Individual Assignments of CDS2002 – Introduction to Artificial Intelligence

Criteria	Very good (4-6)	Satisfactory (2-4)	Unsatisfactory (0-2)
Recognize the characteristics of AI algorithms (LO2)	The AI programs developed by the student demonstrate the right characteristics of those AI algorithms. Moreover, the implementations are correct.	The AI programs developed by the student demonstrate the right characteristics of those AI algorithms. However, the implementations have some minor errors.	The AI programs cannot be developed, or the programs developed demonstrate the wrong characteristics of those AI algorithms.
Recognize the effectiveness of AI algorithms (LO2)	The developed AI programs are very effective.	The developed AI programs are effective to some degree..	The AI programs cannot be developed, or the developed AI programs are ineffective.
Apply different knowledge representations under different scenarios (LO3)	The right knowledge representations are implemented correctly in the AI program.	The right knowledge representations are implemented in the AI program. But there are some errors in the implementations.	The right knowledge representations are not implemented in the AI program, or the implementations have many errors.
Compare different knowledge representations under different scenarios (LO3)	Different knowledge representations are attempted and compared successfully. Correct experiments are performed to determine which representation(s) are suitable for the problems.	Different knowledge representations are attempted and compared successfully. Yet, incorrect experiments are performed to determine which representation(s) are suitable for the problems.	Different knowledge representations are not attempted and compared.

Rubric for Project Presentation of CDS2002 – Introduction to Artificial Intelligence

Criteria	Very good (4-6)	Satisfactory (2-4)	Unsatisfactory (0-2)
Appropriate time allocation and pace.	Allocates time appropriately, and manages time effectively, with smooth progression. Appropriate pace. Starts presentation punctually.	Marginally long or marginally short but uses time reasonably effectively. Reasonable pace. Starts presentation relatively punctually.	Significantly too short or too long and did not use time effectively. Pace is significantly too fast or too slow. Don't start presentation punctually.
Clear, logically organized and relevant content.	Information included is always relevant. Clearly stated and developed points. Material flows extremely well and is well organized. No ambiguities are left unexplained.	Information included is generally relevant. Key points are relatively clear. Most information is presented in logical sequence; sufficiently organized with generally satisfactory flow. Some ambiguities are left unexplained.	Much of the information included is not relevant and/or even key points are not clear. Presentation is choppy or disjointed, does not flow well, and has no apparent logical order.
Effective use of presentation tools.	Balanced and proper use of presentation tools with little or no distraction (e.g., appropriate animation/pictures, appropriate information on one slide, good color combination, clear titles, etc.)	Generally good use of presentation tools. Some distractions but they are not overwhelming (e.g., reasonable animation/pictures, fair information on one slide, fair color combination, fair titles, etc.)	Poor use of presentation tools and/or many distractions (e.g., too much/many animation/pictures, too much information on one slide, poor color combination, absence of titles, etc.)
Uses good body language, eye contact, appropriate voice tone.	Shows poise and composure; makes good eye contact with audience; balanced posture; shows enthusiasm and confidence; uses voice tone effectively.	Fairly poised and composed; makes fairly good eye contact with audience; balanced posture; shows some enthusiasm and confidence; uses voice tone relatively effectively.	Little poise and composure; makes little or no eye contact with audience; poor posture; shows little or no enthusiasm and confidence; uses voice tone ineffectively or too monotonously.
Gains/holds attention	Provides good motivation to engage the audience's interest. Presents the content in a manner that captivates the audience's attention.	Provides reasonable motivation to engage the audience's interest. Audience is reasonably engaged but there are instances where the presentation is otherwise dull.	Provides insufficient motivation to engage the audience's interest. Dull presentation of content that does not engage the audience.
Uses instructor defined role appropriate dress	Professionally dressed as expected by the instructor.	Minor deviations from instructor's expectations.	Do not dress in a manner expected by the instructor.
Clarity of speech/Accuracy of grammar & pronunciation	Voice is consistently comprehensible; grammar and pronunciation are accurate.	Voice is generally comprehensible; grammar and pronunciation are adequate but with some mistakes.	Voice is incomprehensible on several occasions; many mistakes in terms of grammar and pronunciation.

Rubric for Group Written Assignment of CDS2002 – Introduction to Artificial Intelligence

Criteria	Very good (4-6)	Satisfactory (2-4)	Unsatisfactory (0-2)
Problem definition (demonstrate the understanding of the problem and formulate alternative solutions) (LO4)	Clearly state the problem, list out related constrains, and able to formulate alternative solutions.	The problem is stated but related constrains and alternative solutions are not considered thoroughly.	The problem is marginally defined and with unsatisfactory or no consideration of constrains and alternative solutions.
Creative solution design (LO4)	The design of the solution is strongly related to the problem and clearly explains the approaches and techniques involved. Moreover, the design of the solution is very creative.	The design of the solution is related to the problem but the approach and techniques involved are not clearly explained. Moreoever, the design of the solution is not very creative.	The design of the solution is weakly related to the problem and little or no explanation of the approach and technique are involved. The design of the solution is not creative.
Develop intelligent systems (LO5)	The system is implemented correctly using the right inference strategies and knowledge representations.	The system is implemented. However, the right inference strategies and the right knowledge representations have not been used.	The system cannot be implemented, or the system has too many errors and generates incorrect outcomes.

Rubric for Class Attendance and Participation of CDS2002 – Introduction to Artificial Intelligence

Criteria	Very good (4-6)	Satisfactory (2-4)	Unsatisfactory (0-2)
Attendance	The student attends over 85% of all classes.	The student attends at least 60% of all classes.	The student attends less than 60% of the classes.
Punctuality	The student is punctual over 85% of the time.	The student is punctual at least 60% of the time.	The student is punctual less than 60% of the time.
Identify and describe different types of intelligent agents (LO1)	The student can correctly identify and describe different types of intelligent agents.	The student can partially correctly identify or describe different types of intelligent agents.	The student cannot identify nor describe different types of intelligent agents.
Recognize the characteristics of AI algorithms (LO2)	The characteristics of different AI algorithms can be presented correctly.	The characteristics of different AI algorithms can be presented. There are some mistakes in the presentations.	The characteristics of different AI algorithms cannot be presented correctly.
Compare different knowledge representations (LO3)	The student can compare all knowledge representations correctly.	The student can compare some or most knowledge representations correctly.	The student can compare very few knowledge representations correctly.