Xi'an Jiaotong-Liverpool University
西交利物浦大学

Department of Computing

MODULE HANDBOOK

CPT 302
Multi-Agent Systems

Prof. ***Ka Lok Man***

Semester ***2***

2021/2022

SECTION A: Basic Information

- **Brief Introduction to the Module**

This module introduces students to multi-agent systems which are computerized system composed of multiple interacting agents within an environment. In the most general case, agents will be acting on behalf of users with different goals and motivations. To successfully interact with each other, they will require the ability to cooperate, coordinate, and negotiate with each other, much as people would do.

After years of research and development, multi-agent systems have become one very important area in Computer Science. The goal of multi-agent systems is to seek methods to build systems that are composed of autonomous agents. These autonomous agents are capable of performing the desired global behaviors without much human intervention

- **Key Module Information**

Module name: *Multi-Agent Systems*

Module code: *CPT 302*

Credit value: *5*

Semester in which the module is taught: *S2*

Pre-requisites needed for the module: *None*

Programmes on which the module is shared: *BEng Computer Science and Technology, BSc Information and Computing Science and BEng Mechartronics and Robotic Systems*

- **Delivery Schedule**

Lecture room: *Online Education*

Lecture time: *Tuesdays: 3pm-5pm*

Tutorial times: *Tuesdays: 5pm-6pm*

- **Module Leader and Contact Details**

Name: *Prof. Ka Lok Man*

Brief Biography: *Prof. Ka Lok Man holds a Dr. Eng. Degree in Electronic Engineering from Politecnico di Torino, Italy, and a PhD in Computer Science from Technische Universiteit Eindhoven, The Netherlands. He has several years of industrial experience in integrated circuit design. He has a good publication record and to date has about than 500 published academic articles including books, edited books, journal articles, book chapters, and conference proceedings.*

Email address: *ka.man@xjtlu.edu.cn*

Office telephone number: *0512-8816-1509*

Room number and office hours: *SD437; Tuesdays: 1pm-3pm*

Preferred means of contact: *e-mail*

- **Additional Teaching Staff and Contact Details**

None.

SECTION B: What you can expect from the module

- **Educational Aims of the Module**

The educational aims of the module are as follows:

1. *to introduce the student to the concept of an agent and multi-agent systems, and the main applications for which they are appropriate;*
2. *to introduce the main issues surrounding the design of intelligent agents;*
3. *to introduce the main issues surrounding the design of a multi-agent society;*
4. *to introduce a contemporary platform for implementing agents and multi-agent systems.*

❑ Learning Outcomes

On successful completion of this module, students are expected to:

1. *understand the notion of an agent, how agents are distinct from other software paradigms (e.g. objects) and understand the characteristics of applications that lend themselves to an agent-oriented solution;*
2. *understand the key issues associated with constructing agents capable of intelligent autonomous action, and the main approaches taken to developing such agents;*
3. *understand the key issues in designing societies of agents that can effectively cooperate in order to solve problems, including an understanding of the key types of multi-agent interactions possible in such systems;*
4. *understand the main application areas of agent-based solutions, and be able to develop a meaningful agent-based system using a contemporary agent development platform.*

❑ Assessment Details

❑ *Initial Assessment*

Sequence	Method	Assessment Type(EXAM or CW)[2]	Learning outcomes assessed *(use codes under Learning Outcomes)*	Duration	Week	% of Final Mark	Resit(Y/N/S)[3]
001	Final Exam	CW	ALL	2hrs	Exam Week	80	N
002	Assessment Task I	CW	1,2		Week 6/7	10	N
003	Assessment Task II	CW	3,4		Week 13/14	10	N

❑ *Resit Assessment*

Sequence	Assessment Type (EXAM or CW)	Learning outcomes assessed *(use codes under Learning Outcomes)*	Duration	Week	% of Final Mark

❑

The University does not allow resits for final year students, whilst the resit opportunity will be introduced for next ordinary sitting of the examinations/assessments for the failed modules.

Assessment Task I (10% of the module mark).

The task: Through a coursework, you are required to design and implement some agents with ability to autonomously modify their interactions in order to react to changes in their environment to achieve some application purpose [assesses Learning Outcomes 1 and 2].

Purpose: In addition to demonstrating your achievement of the module's Learning Outcomes (LOs), this coursework is designed to give you an opportunity to apply some agents (could be designed by you) to solve some common and practical problems in Multi-Agent Systems.

Deadline: The deadline for submission is **5pm on Friday of Week 6/7**. Submissions have to be through LM. Submissions after this date will be subject to penalties as per the university's policy on late submission of assessed coursework.

General information: The length of the coursework report should not exceed 8,000 words (excluding cover page, abstract, graphs, tables, figures, footnotes, codes appendices and reference list).

Grading: The project report will be marked as follows — FAIL: 0-39%, PASS: 40-59, MERIT: 60-69, and DISTINCTION: 70+.

Marking Criteria and Marking Schemes: 70% of the marks will be based on the quality of the scientific thought and critical evaluation evident in the coursework report. Formal academic presentation of the work and comprehension of the coursework contribute 30% to the final mark.

Assessment Task II (10% of the module mark).

The task: Through a coursework, you are required to design and implement societies of agents that can effectively cooperate in order to solve problems, including an understanding of the key types of multi-agent interactions possible in such systems [assesses Learning Outcomes 3 and 4].

Purpose: In addition to demonstrating your achievement of the module's Learning Outcomes (LOs), this coursework is designed to give you an opportunity to develop a meaningful agent-based system using a contemporary agent development platform.

Deadline: The deadline for submission is **5pm on Friday of Week 13/14**. Submissions have to be through LM. Submissions after this date will be subject to penalties as per the university's policy on late submission of assessed coursework.

General information: The length of the coursework report should not exceed 8,000 words (excluding cover page, abstract, graphs, tables, figures, footnotes, codes appendices and reference list).

Grading: The project report will be marked as follows — FAIL: 0-39%, PASS: 40-59, MERIT: 60-69, and DISTINCTION: 70+.

Marking Criteria and Marking Schemes: 70% of the marks will be based on the quality of the scientific thought and critical evaluation evident in the coursework report. Formal academic presentation of the work and comprehension of the coursework contribute 30% to the final mark.

Final Exam (80% of the module mark).

This final exam consists of 5 questions (20%) and they assess all Learning Outcomes 1, 2, 3 and 4. You are required to answer all 5 questions. To obtain the full marks for each question, relevant and clear steps should be included in the answers. Partial marks may be awarded depending on the degree of completeness and clarity.

Exam Date: In the final exam week.

Grading: The project report will be marked as follows — FAIL: 0-39%, PASS: 40-59, MERIT: 60-69, and DISTINCTION: 70+.

Marking Criteria and Marking Schemes: Questions are marked according to the moderated marking scheme.

- **Methods of Learning and Teaching**

Formal live lectures/tutorials:
Students will be expected to attend two hours of formal live lectures and one hour of live tutorial in a typical week.
Private study:
In a typical week, students will be expected to devote a further seven or eight hours of unsupervised time to private study. The time allowed for private study each week will

typically include four hours of time for reflection and consideration of lecture material, and three to four hours of background reading

- **Syllabus & Teaching Plan**

Week number and/or date	Lecture/Seminar/Field trip/other	Topic/Theme/Title	Pre-reading
Week 1	*Lecture 1*	*Introduction to module; agents and objects;*	*ppt available on LM on the same week*
Week 2	*Lecture 2*	*agents and expert systems; agents and distributed systems; typical application areas for agent systems;*	*ppt available on LM on the same week*
Week 3	*Lecture 3*	*the design of intelligent agents - reasoning agents;*	*ppt available on LM on the same week*
Week 4	*Lecture 4*	*agents as reactive systems; hybrid agents;*	*ppt available on LM on the same week*
Week 5	*Lecture 5*	*layered agents ; multi-agent systems;*	*ppt available on LM on the same week*
Week 6	*Lecture 6*	*classifying multi-agent interactions - cooperative versus non-cooperative;*	*ppt available on LM on the same week*
Week 7	*None – Reading week*		
Week 8	*Lecture 8*	*zero-sum and other interactions;*	*ppt available on LM on the same week*
Week 9	*Lecture 9*	*what is cooperation and how cooperation occurs - the Prisoner's dilema and Axelrod's experiments;*	*ppt available on LM on the same week*
Week 10	*Lecture 10*	*interactions between self-interested agents: auctions & voting systems: negotiation;*	*ppt available on LM on the same week*
Week 11	*Lecture 11*	*interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination;*	*ppt available on LM on the same week*
Week 12	*Lecture 12*	*interaction languages and*	*ppt available on LM on*

		protocols: speech acts, KQML/KIF, and the FIPA framework;	*the same week*
Week 13	*Lecture 13*	*advanced topics- one issue selected from the contemporary research literature, perhaps by guest lecturer;*	*ppt available on LM on the same week*
Week 14	*Module Revision*	*module revision*	*ppt available on LM on the same week*

- **Tutorial Schedule**

Student Group	Time	Day	Venue	Lecturer/Instructor
All students	*11am-12pm*	*Tuesdays*	*Online*	*Prof. Ka Lok Man*

- **Reading Materials**

Mandatory Textbooks

Title	Author	ISBN/Publisher

Optional Textbooks

Title	Author	ISBN/Publisher
AN INTRODUCTION TO MULTIAGENT SYSTEMS	M. WOOLDRIDGE	9780470519462 /WILEY

Reference Textbooks

Title	Author	ISBN/Publisher
READING IN AGENTS	M. SINGH AND M. HUHNS	9781558604957 /MORGAN KAUFMANN
MULTIAGENT SYSTEMS	J. FERBER	B01FKS9GKQ /ADDISON-WESLEY PROFESSIONAL
MULTIAGENT SYSTEMS	G. WEISS (EDITOR)	9780262018890 /MASSACHUSETTS INSTITUTE TECHNOLOGY

Additional Readings:

Additional research papers are available on LM.

SECTION C: Additional Information

- **Attendance**
  Students who are able to be on campus are reminded of the Academic Policy requiring no less than 80% attendance at classes. Failure to observe this requirement may lead to failure or exclusion from retake examinations in the following year.

- **Student Feedback**
  The University is keen to require student feedback to make improvements for each module in every session. It is University policy that the preferred way of achieving this is by means of an Online Module Evaluation Questionnaire Survey. Students will be invited to complete the questionnaire survey for this module at the end of the semester.

You are strongly suggested to read policies mentioned below very carefully, which will help you better perform in your academic studies. All the policies and regulations related to your academic study can be found in Student Academic Services section under the heading "Policies and Regulations" on E-bridge.

- **Plagiarism, Cheating, and Fabrication of Data.**
  Offences of this type can result in attendance at a University-level committee and penalties being imposed. You need to be familiar with the rules. Please see the "Policy for Dealing with Plagiarism, Collusion and Data Fabrication" document available on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Rules of submission for assessed coursework**
  The University has detailed rules and procedures governing the submission of assessed coursework. You need to be familiar with them. Details can be found in the "Code of Practice for Assessment" document available on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Late Submission of Assessed Coursework**
  The University attaches penalties to the late submission of assessed coursework. You need to be familiar with the University's rules. Details can be found in the "Code of Practice for Assessment" document available on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Mitigating Circumstances**

  The University is able to take into account mitigating circumstances such as illness or personal circumstances which may have adversely affected student performance on a module. It is the student's responsibility to keep their Academic Adviser, Programme Director or Head of Department informed of illness and other factors affecting their progress during the year and especially during the examination period. Students who believe that their performance on an examination or assessed coursework may have been impaired by illness, or other exceptional circumstances should follow the procedures set out in the Mitigating Circumstances Policy, which can be found on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Learning Mall**

  Copies of lecture notes and other materials are available electronically through Learning Mall, the University's virtual learning environment.