UNIT OVERVIEW

Introduction
This unit covers the principles involved in the design and implementation of intelligent software agents. It discusses current research being undertaken to develop agent systems for use in the internet environment. It builds on basic artificial intelligence concepts to explain the fundamentals of agent design and introduces various commonly used agent architectures. Agent communication, cooperation and learning are discussed and the unit concludes by showing how these concepts can be incorporated into the process of building a multi-agent system. Students learn the principles of agent-based programming by undertaking the design and implementation of a multi-agent system, using a suitable programming environment.

Prerequisites
KXA252 or KXT206/306

Unit Weight
12.5% of one academic year

Teaching Pattern
Lectures: 3hr/wk

Unit Content
Agents in Theory and Practice:
- Theoretical Definition of an Agent
- Reflex and Goal-based Agents
- Agent Environments
- The Unifying Role of the Agent Concept in AI
- Application-based Definition of an Agent
- Agent Characteristics

**e-Commerce Agents:**
- Shopping Agents
- Middle Agents
- Recommender Systems

**Deliberative vs Reactive Architectures:**
- The Deliberative Paradigm
- Modular Horizontal Architectures
- Limitations of Early Deliberative Architectures
- The "New AI" Approach
- Subsumption and Other Reactive Architectures
- Emergent Behaviour
- Advantages and Limitations of Reactive Agents

**Hybrid Architectures:**
- Real-time Deliberative Architectures
- Deliberative Architectures for Open Worlds
- The Hybrid Paradigm
- Examples of Hybrid Systems
- BDI Architectures
- Evaluation of Hybrid Architectures

**Agents in Software Environments:**
- The "Software Robot"
- Advantages of Software Environments
- Software Agents on the Internet

**Agent Communication:**
- Types of Communication
- Speech Acts
- Conversations
- Agent Communication Languages
- KIF and KQML
- Ontologies and OWL

**Agent Negotiation:**
- Agent Cooperation
- Utilities and Preferences
- The Payoff Matrix
- The Prisoner’s Dilemma
- The Nash Equilibrium
- Negotiation Protocols
- Auctions
- Strategic Bargaining
- Coalition Formation

**Agent Coordination:**
- Cooperative Distributed Problem Solving
- Task Allocation
- Allocation by Broker
- Allocation by Acquaintance Networks
- The Contract Net

**Agent Infrastructure:**
- The Semantic Web
- Markup Languages
- Ontologies and Ontology Languages
- Logics and Proof Systems
- Web Services

**Mobile Agents:**
- Introducing Mobility
- Facilitating Mobility
- Mobile Agent Systems
- Aglets
- Mobile Agent Security

**Trust, Security and Legal Issues:**
- Perceived Risks
- Trust in e-Commerce
- Electronic Institutions
- Reputation Systems
- Security and Cryptography
Future Impact:

- Privacy and Anonymity
- Electronic Business
- Ambient Intelligence
- Scientific Grid Computing
- Education and Entertainment

For more information see the section titled ‘Content’ on the unit website.

**Prior Knowledge and/or Skills**

Students entering this unit will be assumed to have a knowledge of basic Artificial Intelligence concepts.

**Learning Outcomes**

On successful completion of this unit, you will be able to:

1. understand the concept of an intelligent agent as a core unifying concept in the Artificial Intelligence field.
2. recognise the common properties generally regarded as being characteristic of agent software, including autonomy, adaptability, knowledgability, collaboration and mobility.
3. describe the range of agent types and relate these to recognised applications of agent technology within scientific, commercial, industrial and educational environments.
4. describe the main deliberative, reactive and hybrid agent architectures and outline the benefits and limitations of each.
5. design and implement a multi-agent system, using a recognised agent programming environment.

**Generic graduate attributes**

The university has defined a set of generic graduate attributes expected in its graduates. [http://www.utas.edu.au/policy/subject.html#graduates](http://www.utas.edu.au/policy/subject.html#graduates) Your course is designed to enable you to develop generic skills that are valued in, and expected of, graduates. These are skills that you will need to develop over time. Hence you are encouraged to look for opportunities, as you study each unit, to reflect on and improve these skills.

1. Apply technical and information skills appropriate to your professional area.
2. Demonstrate written and graphic communication skills.
3. Present well-reasoned arguments, using technology as appropriate.
4. Conceptualise problems and formulate a range of solutions.
5. Acknowledge the social and ethical implications of your actions.

### UNIT ASSESSMENT

**Assessment Pattern**

Internal (40%), Exam (60%).

**Assessment Summary**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Assignment</td>
<td>10%</td>
<td>Wednesday 2nd April at 3 pm.</td>
</tr>
<tr>
<td>Practical Assignment</td>
<td>30%</td>
<td>Wednesday 7th May at 3 pm.</td>
</tr>
<tr>
<td>3 hr Examination</td>
<td>60%</td>
<td>University Examination Period</td>
</tr>
</tbody>
</table>

**Assessment Items**

**Item 1**

**Title:** Written Assignment  
**Type:** In-Semester - individual assignment  
**Task Length:** 1500 to 1800 words  
**Weighting:** 10%  
**Links to Learning Outcomes:** 1, 2, 3  
**Due:** Wednesday 2nd April at 3 pm.  
**Description:** This assignment will require you to prepare and submit a short paper discussing a specified topic related to the application of software agent technology within the Internet environment. The topic to be discussed will be specified at the beginning of the semester.

**Item 2**

**Title:** Practical Assignment  
**Type:** In-Semester - individual assignment  
**Task Length:** not applicable  
**Weighting:** 30%  
**Links to Learning Outcomes:** 1, 4, 5  
**Due:** Wednesday 7th May at 3 pm.  
**Description:** This assignment will require you to design and implement a multi-agent system, using the
Breve 3d Simulation Environment. The system to be developed will be specified early in the semester. A skeleton system will be provided to you as a starting point.

Item 3
Title: 3 hr Examination
Type: Formal Examination
Task Length: 3 hrs
Weighting: 60%
Links to Learning Outcomes: 1, 2, 3, 4
Due: University Examination Period
Description: This is a closed book examination.

See the 'Assessment' section in unit website for more detailed information about assessment items.

How your Final Grade will be determined

Overall assessment will be based on the student's performance throughout the semester as well as in a formal examination. In order to achieve a pass (or better) result, a student must obtain:

1. at least 45% of the total mark for in-semester assessment items
2. at least 45% of the mark for the formal examination
3. at least 50% of the overall mark

UNIT RESOURCES

Unit Web Site
This unit is Web Dependent: content. This means that you will need to use the Web for this unit. The unit website contains unit information and resources.
The unit website is accessed from http://www.utas.edu.au/coursesonline/. You will need to use your university email pop account username and password to log on to the MyLO system. Once authenticated by the system your personalised MyLO Learning Online area will be displayed. It contains links to the websites that you have permission to access - including the website for this unit.
If you are not able to access the unit website, please contact the University IT help desk:
    Entrance Level, Morris Miller Library, Sandy Bay Campus;
    Entrance Level, Launceston Campus Library, Newnham Campus.
    Telephone: 6226 1818 and 1300 304 903.
The 1300 number is a local call from within Tas, with the exception of mobiles.
Email: servicedesk@utas.edu.au
Website: http://www.utas.edu.au/servicedesk/student/index.html

Prescribed Text
None

Readings
A useful recent text dealing with agent technology specifically within an e-Commerce environment is:

A classic AI text which uses the agent concept as a common principle underlying the study of Artificial Intelligence is:

Other relevant reference books for this unit are:

The books by Fasli and by Russell & Norvig are available on reserve in both the Science and Launceston libraries. The other books are on reserve in either one library or the other. Specified chapters from these other books are also available on the unit website. A selection of other readings is also available on the unit website.

Software
The software that you will need to access the unit website and to study this unit, including general purpose software such as word processors, is provided on the computers in the School's computing labs. If you intend to use software on other computers please check that the versions are compatible. The agent programming environment to be used in this unit is the Breve 3d Simulation Environment. This is available for the MacOS X operating system and has been installed on all computers in both Macintosh laboratories on each of the Launceston and Hobart campuses. This version, and an alternative Windows-based version, is available for download from the Breve website (www.spiderland.org/breve). A link to this site is available on the KXA463 unit website.
School Website
School of Computing and Information Systems - Faculty of Science, Engineering, and Technology.
http://www.cis.utas.edu.au

Faculty Website
Information and Resources for Faculty of Science, Engineering and Technology students are available on the faculty website at: http://www.utas.edu.au/scieng

University Website
Information and Resources for 'Current Students' are available on the university website at: http://www.utas.edu.au/students/

School Help Desk
Contact the School Help Desk if you have any queries or problems with accessing, using, or printing from the computers in the School of Computing and Information Systems labs.

In Hobart the Help Desk is located on level 3 in the Centenary building, and is open from 10:00am-12:00pm, and 2:00pm-4:00pm Monday- Friday. The phone number is 62262929.

In Launceston the Help Desk is located near the entrance to the computing labs and is open from 10:00am-12:00pm, and 2:00pm-4:00pm Monday-Friday. The phone number is 6324 3447.

Both help desks will accept queries over the phone outside the standard opening hours.

The computer labs at the Cradle Coast Campus are maintained by ITR - please contact the University Help Desk for assistance with these computers.

Computing Facilities
The School has PC labs (running Windows XP), Mac labs (running Mac OS X 10.5), and special purpose Networking labs at the Newnham and Sandy Bay campuses. All students are provided with logins for Windows, Macintosh and Unix environments. If you have not used these facilities before please contact the School Help Desk to collect your account details. If you would like to access these facilities after hours please contact the School Help Desk.

In Hobart, there are 3 PC labs, 2 Mac Labs, and 1 Networks lab in the Centenary building, and 3 PC labs in the CIS building. In Launceston, there are 2 PC labs, 1 Mac Lab, 1 Networks lab, and one multipurpose lab in Building V.

Use of Facilities
Use of computing facilities provided by the School is subject to the School's Ethics Guidelines, details of which are posted at http://www.cis.utas.edu.au/cisview/ethics.jsp. Copies of the guidelines are also available in all School labs. The School's facilities may only be used for study-related purposes, and may not be used for personal gain. Anti-social behaviour in labs such as game playing, viewing pornography, loud discussion, audio without the use of head-phones, etc is strictly prohibited in all labs at all times. Eating, drinking, and smoking is not permitted in the labs. Before being granted access to the School's facilities, you will be required to sign a declaration that you have read and understand these guidelines, and that you will abide by them. Disciplinary action may be taken against students who violate the guidelines.

Learning Strategies
If you need assistance in preparing for study please refer to your tutor or lecturer. For additional information refer to the Learning Development website: http://www.utas.edu.au/learndev/

If you will be using MyLO for the first time and would like some information on how to use MyLO refer to the following website: http://www.utas.edu.au/coursesonline/mylo-support.htm

Some of the units you will study use videoconferencing to deliver lectures and tutorials. To enable you to get the best out of a videoconference please refer to the following guide: http://www.its.utas.edu.au/videoconf/vcstudentguide.pdf

Help resolving concerns about this unit
In the first instance you should contact your lecturer. If the matter is not resolved then you should contact the Head of School. If the matter is still unresolved and you would like to know who to contact or the procedures for resolving your concern refer to the following website: http://acserv.admin.utas.edu.au/complaints_info.html

The Hobart based Tasmanian University Union (TUU) or the Launceston/Burnie based Student Association (SA) may also be able to assist.

The School reserves the right to alter the details contained in this Unit Outline. Students will be advised of changes to the outline via their University email account and it remains the responsibility of the student to check their email for such changes.

Occupational Health and Safety
The university is committed to providing a safe and secure teaching and learning environment. For more information see [http://www.admin.utas.edu.au/hr/ohs/pol_proc/](http://www.admin.utas.edu.au/hr/ohs/pol_proc/)

**University Services and Support**

If you are experiencing difficulties with your studies or assignments, have personal or life planning issues, disability or illness which may affect your course of study, you are advised to raise these with your lecturer in the first instance.

The University has staff available to assist you, such as the:

- Learning Development Advisor
- Student Counselor
- Careers Advisor
- Disability Officer

For more information and contact details see the Services and Support section on the University 'Current Students' web page: [http://www.utas.edu.au/students/](http://www.utas.edu.au/students/)

**GENERAL ASSESSMENT**

**Approach to Learning**

The University is committed to high standards of professional conduct in all activities, and holds its commitment and responsibilities to its students as being of paramount importance. Likewise, it holds expectations about the responsibilities students have as they pursue their studies within the special environment the University offers.

The University’s Code of Conduct for Teaching and Learning states:

> Students are expected to participate actively and positively in the teaching/learning environment. They must attend classes when and as required, strive to maintain steady progress within the subject or unit framework, comply with workload expectations, and submit required work on time.

You are expected to spend about 130 hrs studying in this unit - this includes attendance at scheduled teaching sessions. (For a 13 week semester this is, on average, 10 hr/wk.) This is the amount of study time that the 'typical' student will need to reach the level of competence and understanding required to fulfil the unit objectives. You are expected to:

- attend all scheduled teaching sessions, unless otherwise notified by the unit coordinator
- prepare for, and actively participate in all scheduled teaching sessions
- complete the assigned learning tasks
- review what has been learnt
- complete assessment items and submit them on time
- access and be familiar with the information and resources available on the unit website
- seek help from teaching staff if you have any questions or difficulties in studying this unit

You are encouraged to read the university’s Code of Conduct for Teaching and Learning. Part A describes the 'Responsibility of the University to Students' and part B describes the 'Responsibilities of Students to the University'. [http://www.utas.edu.au/tl/policies/codes.html](http://www.utas.edu.au/tl/policies/codes.html)

It is expected that students will familiarise themselves with access and use of the MyLO system operated by the University for the electronic delivery of course materials, and for various forms of communication.

It is expected that students will consult email sent to their University email address at least twice a week for notices relating to the administration of the unit, and for notification of the results of assignments.

It is expected that students will read the background material specified in the course curriculum, will actively attend and participate in tutorials, and be prepared to discuss relevant issues arising with tutors, lecturers and fellow students.

**Student Expectations of the Unit**

Students enrolled in this Unit may reasonably expect the following:

1. To be able to contact a lecturer or tutor by electronic mail, to raise issues arising in the unit, either relating to content or student performance within the unit.
2. Subject to availability, to be able to discuss such issues in person with the lecturer or tutor.
3. That assignments will be marked and the marks will normally be returned within 3 weeks of due dates.
4. That all relevant notices regarding the administration of the unit, including any necessary changes, will be communicated to all students enrolled in the unit via email.

*These expectations are in addition to those specified in relevant University regulations.*

**Plagiarism**
Unless specifically stated in the specification of the assessment item provided on the unit website, it is required that:

- work submitted by a student is the work of that student alone OR
- where the assessment item is to be completed by a group of students, the work submitted by the group of students is the work of that group of students alone.

While students are encouraged to discuss the assignments in this unit and to engage in active learning from each other, it is important that they are also aware of the University’s policy on plagiarism. Plagiarism is taking and using someone else’s thoughts, writings or inventions and representing them as your own; for example downloading an essay wholly or in part from the internet, copying another student’s work or using an author’s words or ideas without citing the source.

"Plagiarism is a form of cheating. It is taking and using someone else's thoughts, writings or inventions and representing them as your own; for example, using an author's words without putting them in quotation marks and citing the source, using an author's ideas without proper acknowledgment and citation, copying another student's work."

If you have any doubts about how to refer to the work of others in your assignments, please consult your lecturer or tutor for relevant referencing guidelines, and the academic integrity resources on the web at http://www.utas.edu.au/tl/supporting/academicintegrity/index.html.

The intentional copying of someone else’s work as one’s own is a serious offence punishable by penalties that may range from a fine or deduction/cancellation of marks and, in the most serious of cases, to exclusion from a unit, a course or the University. Details of penalties that can be imposed are available in the Ordinance of Student Discipline – Part 3 Academic Misconduct, see http://www.utas.edu.au/universitycouncil/legislation/.

The University and any persons authorised by the University may submit your assessable works to a plagiarism checking service, to obtain a report on possible instances of plagiarism. Assessable works may also be included in a reference database. It is a condition of this arrangement that the original author’s permission is required before a work within the database can be viewed.

Referencing

The preferred text referencing systems for the School is the Harvard system (also referred to as the author-date system). In your written work you will need to support your ideas by referring to scholarly literature, works of art and/or inventions. For information on presentation of assignments, including referencing styles: http://www.utas.edu.au/library/assist/gpoa/gpoa.html

It is important that you understand how to correctly refer to the work of others and maintain academic integrity. Failure to appropriately acknowledge the ideas of others constitutes academic dishonesty (plagiarism), a matter considered by the University of Tasmania as a serious offence. The university document on plagiarism contains information about referencing the work or ideas of others (see http://www.utas.edu.au/plagiarism/).

Submissions

The details of the submission method (paper, electronic or other) for each assignment will be supplied in a separate assignment specification sheet. All in-semester assignment submissions (including electronic submissions) are to include an Assignment Cover Sheet which includes a statement confirming that the submission is your own work. The Assignment Cover Sheet is available from the School Help Desk in Launceston and Hobart, and on the School's web site: http://www.cis.utas.edu.au/cisview/studyresources.jsp.

Students must take responsibility for the correct submission of their assignments. Students are expected to adhere to the following procedure for submission:

- Submitted files MUST be checked by the student to ensure that correct submission of the file has been undertaken.
- Students are expected to notify the Lecturer WITHIN TWO HOURS of submission if their files have not been submitted correctly.
- Students must take responsibility for safely backing up of their own files during the academic year to ensure that no files are permanently lost.

Extensions

Assessment items will not be accepted after the due date except under the conditions stated in the school policy on late assessment. http://www.cis.utas.edu.au/downloads/ExtensionPolicy.pdf (PDF - 100KB).

Review of Assessment and Appeals

1. It is expected that students will adhere to the following policy for review of any piece of continuous assessment.
Within 5 days of the release of the assessment result, the student should request an appointment with the Lecturer. The student should be prepared to discuss specifically which section of the marking criteria they are disputing and why they consider the mark is inappropriate.

b. Following this discussion, students may request a formal remark of the original submission (in accordance with Rule of Academic Assessment 111, clause 22.1). This remark will be undertaken, where practicable, by an alternative assessor.


Complaints Procedure

It is expected that students will adhere to the following policy for making any complaint or grievance directly related to a Unit:

a. In the first instance, students are to approach the Lecturer or Unit Coordinator concerned and arrange a time to speak with them about their concern.

b. If an issue remains unresolved, the student should approach the Head of School and arrange a time to speak with them about their concern.

If the School’s internal policy of complaints is unable to resolve an issue, students should consult Ordinance 8 Student Complaints for further direction, see [http://acserv.admin.utas.edu.au/complaints_info.html](http://acserv.admin.utas.edu.au/complaints_info.html)

Formal Examination

The formal examination is conducted by the University Registrar. The ‘Current Students’ section on the university website contains information about the conduct of, and timetable for, formal examinations.

Final Grade

Passing grades will be awarded based on the AVCC guidelines:

- **PP** at least 50% of the overall mark but less than 60%
- **CR** at least 60% of the overall mark but less than 70%
- **DN** at least 70% of the overall mark but less than 80%
- **HD** at least 80% of the overall mark

In order to comply with the benchmarks set by the Faculty of Science, Engineering & Technology for distribution of grades in units, both the in-semester and examination marks that students obtain may be adjusted either upwards or downwards. See [http://fcms.its.utas.edu.au/scieng/scieng/policies.asp](http://fcms.its.utas.edu.au/scieng/scieng/policies.asp) for details of the Faculty Assessment Guidelines.