KIT205

DATA STRUCTURES AND ALGORITHMS

12.50 Credit points

Semester 1, 2019

Unit Outline

Unit Coordinator
Dr Robert Ollington
## CONTACT DETAILS

### Unit coordinator

<table>
<thead>
<tr>
<th>Unit coordinator:</th>
<th>Robert Ollington</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus:</td>
<td>Sandy Bay</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:Robert.Ollington@utas.edu.au">Robert.Ollington@utas.edu.au</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>6226 2991</td>
</tr>
<tr>
<td>Room location and number:</td>
<td>Centenary Room 467</td>
</tr>
<tr>
<td>Consultation hours:</td>
<td></td>
</tr>
</tbody>
</table>

### Other teaching staff

<table>
<thead>
<tr>
<th>Launceston Tutor:</th>
<th>Ms Amanda Lunt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus:</td>
<td>Newnham</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:Amanda.Lunt@utas.edu.au">Amanda.Lunt@utas.edu.au</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>6324 3326</td>
</tr>
<tr>
<td>Room location and number:</td>
<td>Building V, room 168</td>
</tr>
<tr>
<td>Consultation hours:</td>
<td>To be announced.</td>
</tr>
</tbody>
</table>
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WHAT IS THE UNIT ABOUT?

Unit description

This unit extends the first year treatment in KIT107 of standard data structures and algorithms for solving computational problems. Topics include: data structures (such as balanced trees and hash tables) for collections, (binary heaps for) priority queues, sorting algorithms (e.g. heapsort, mergesort and quicksort), graphs and graph algorithms (e.g. for searching, topological sorting, critical path analysis, shortest paths, minimum spanning trees, network flow), pattern finding (for substrings and regular expressions), algorithmic problem solving and algorithm design techniques (e.g. greed, divide and conquer, dynamic programming, backtracking).

Intended Learning Outcomes

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

1. transform a real-world problem into a simple abstract form that is suitable for efficient computation
2. implement common data structures and algorithms using a common programming language
3. analyse the theoretical and practical run time and space complexity of computer code in order to select algorithms for specific tasks
4. apply common algorithm design strategies to develop new algorithms when there are no pre-existing solutions
5. create diagrams to reason and communicate about data structures and algorithms

Graduate Quality Statement

Successful completion of this unit supports your development of course learning outcomes, which describe what a graduate of a course knows, understands and is able to do. Course learning outcomes are available from the Course Coordinator. Course learning outcomes are developed with reference to national discipline standards, Australian Qualifications Framework (AQF), any professional accreditation requirements and the University of Tasmania’s Graduate Statement.
The University of Tasmania experience unlocks the potential of individuals. Our graduates are equipped and inspired to shape and respond to the opportunities and challenges of the future as accomplished communicators, highly regarded professionals and culturally competent citizens in local, national, and global society. University of Tasmania graduates acquire subject and multidisciplinary knowledge and skills, and develop critical and creative literacies and numeracies and skills of inquiry. They demonstrate the ability to apply this knowledge in changing circumstances. Our graduates recognise and critically evaluate issues of social responsibility, ethical conduct and sustainability, are entrepreneurial and creative, and are mindful of their own wellbeing and that of the community. Through respect for diversity and by working in collaborative ways, our graduates reflect the values of the University of Tasmania.

Alterations to the unit as a result of student feedback

Improved lecture recordings and tweaks to weekly quizzes

Prior knowledge &/or skills

The student is assumed to have a knowledge of programming (in C), and of elementary algorithms and data structures, as covered in the prerequisite unit: Programming KIT107.
HOW WILL I BE ASSESSED?

Assessment schedule

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Date due</th>
<th>Percent weighting</th>
<th>Links to Intended Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Quiz</td>
<td>Tutorials in weeks 4-12</td>
<td>10</td>
<td>LO3, LO4, LO5</td>
</tr>
<tr>
<td>Code Walkthrough</td>
<td>Week 4 Tutorial</td>
<td>5</td>
<td>LO2</td>
</tr>
<tr>
<td>Examination - invigilated (externally - Exams Office)</td>
<td>Exam Period</td>
<td>60</td>
<td>LO2, LO3, LO4, LO5</td>
</tr>
<tr>
<td>Assignment</td>
<td>Week 8</td>
<td>10</td>
<td>LO1, LO2</td>
</tr>
<tr>
<td>Assignment</td>
<td>Week 13</td>
<td>15</td>
<td>LO1, LO2</td>
</tr>
</tbody>
</table>

Assessment details

Assessment Task 1: Weekly Quizzes

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Criterion Description</th>
<th>Measures ILO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use written and diagrammatic approaches to answer questions related to data structures and algorithms.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criterion Number</td>
<td>Criterion Description</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Analyse short code segments to determine run time and space complexity</td>
<td>LO3</td>
</tr>
<tr>
<td>2</td>
<td>Justify algorithm choice based on run time and space complexity</td>
<td>LO3</td>
</tr>
<tr>
<td>3</td>
<td>Identify the design strategies used by common algorithms</td>
<td>LO4</td>
</tr>
<tr>
<td>4</td>
<td>Apply one or more design strategies to the development of a new algorithm</td>
<td>LO4</td>
</tr>
<tr>
<td>5</td>
<td>Demonstrate understanding of common data structures and associated algorithms</td>
<td>LO5</td>
</tr>
<tr>
<td>Task Length</td>
<td>10 x 30mins</td>
<td></td>
</tr>
<tr>
<td>Due by date</td>
<td>Monday 9am of weeks 4-12</td>
<td></td>
</tr>
</tbody>
</table>
**Assessment Task 2: Code Walkthrough**

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demonstrate lab work completed so far and guide the marker through the structure of your code. This work will cover implementation of foundation data structures and test code. You will also be asked to describe how you would modify your code to address hypothetical situations.</td>
<td>LO2</td>
</tr>
</tbody>
</table>

**Criterion Number**

<table>
<thead>
<tr>
<th>Criterion Number</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate correctness and understanding of data structure code</td>
<td>LO2</td>
</tr>
</tbody>
</table>

**Task Length**

2-3 minutes

**Due by date**

Assessed in Your Week 4 Tutorial

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**Assessment Task 3: Examination - invigilated (externally - Exams Office)**

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Examination consisting of short written problems to test understanding of data structures and algorithms; programming questions.</td>
<td>LO2</td>
</tr>
</tbody>
</table>

**Criterion Number**

<table>
<thead>
<tr>
<th>Criterion Number</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Implement generic list data structures and algorithms</td>
<td>LO2</td>
</tr>
<tr>
<td>2</td>
<td>Implement generic tree data structures and algorithms</td>
<td>LO2</td>
</tr>
<tr>
<td>3</td>
<td>Implement generic graph data structures and algorithms</td>
<td>LO2</td>
</tr>
<tr>
<td>4</td>
<td>Analyse short code segments to determine run time and space complexity</td>
<td>LO3</td>
</tr>
<tr>
<td>5</td>
<td>Apply one or more design strategies to the development of a new algorithm</td>
<td>LO4</td>
</tr>
<tr>
<td>6</td>
<td>Create diagrams to demonstrate understanding of common data structures and algorithms</td>
<td>LO5</td>
</tr>
</tbody>
</table>

**Task Length**

3 hours

**Due by date**

Exam Period

---

**Assessment Task 4: Assignment 1**

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Implement data storage application using linked list and binary search tree data structures and associated algorithms.</td>
<td>LO2</td>
</tr>
</tbody>
</table>

**Criterion Number**

<table>
<thead>
<tr>
<th>Criterion Number</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select appropriate data structures to store problem-specific data</td>
<td>LO1</td>
</tr>
<tr>
<td>2</td>
<td>Adapt generic data structures for use in a specific problem</td>
<td>LO1</td>
</tr>
<tr>
<td>3</td>
<td>Implement generic list data structures and algorithms</td>
<td>LO2</td>
</tr>
</tbody>
</table>
Assessment Task 5: Assignment

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Criterion Description</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use graph data structures and algorithms to solve a network-based computing problem.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criterion Number</td>
<td>Criterion Description</td>
<td>ILO:</td>
</tr>
<tr>
<td>1</td>
<td>Apply graph data structures and algorithms to solve a specific problem</td>
<td>LO1</td>
</tr>
<tr>
<td>2</td>
<td>Implement generic graph data structures and algorithms</td>
<td>LO2</td>
</tr>
<tr>
<td>Task Length</td>
<td>~500LOC</td>
<td></td>
</tr>
<tr>
<td>Due by date</td>
<td>Week 13 Friday, 31st May, 11:55pm</td>
<td></td>
</tr>
</tbody>
</table>

How your final result is determined

To pass this unit, you need to demonstrate your attainment of each of the Intended Learning Outcomes.

Assessment will be based on your performance throughout the semester as well as in the formal examination. In order to achieve a pass (or better) result, you must obtain:

1. at least 45% of the combined 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, and
4. you need to demonstrate your attainment (gain at least 40% in) of each of the Intended Learning Outcomes (ILOs).

Your overall mark in this unit will be determined by combining your results from each assessment task. These marks are combined to reflect the percentage weighting of each task. You need to achieve an overall score of at least 50% to successfully complete this unit. It is expected that you will seek help (from the unit coordinator in the first instance), well before the due date, if you are unclear about the requirements for an assessment task.

- PP (pass) at least 50% of the overall mark but less than 60%
- CR (credit) at least 60% of the overall mark but less than 70%
- DN (distinction) at least 70% of the overall mark but less than 80%
- HD (high distinction) at least 80% of the overall mark
All grades are provisional, until confirmation by the Assessment Board at the end of semester.
Submission of assignments

The act of submitting your assignment will be taken as certification that it is your own work.

The details of the submission method (paper, electronic or other) for each assignment will be supplied in a separate assignment specification sheet.

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.

Requests for extensions

Assessment items will not be accepted after the due date except under the conditions stated in the Discipline policy on late assessment. http://www.utas.edu.au/__data/assets/pdf_file/0003/231960/ExtensionPolicy.pdf (PDF 100KB). A request for an extension to the due date for an assessment task should be made in writing and submitted to the Unit Coordinator THREE (3) days before the assignment due date. Independent documentation (medical certificate, counsellor’s report, etc.) in support of the application should be attached to the form OR a current Learning Access Plan may be used as supporting documentation, as appropriate.

If you are ill on the day of an examination or have other serious circumstances which prevent you from sitting an examination, you may apply for a deferred examination (see http://www.utas.edu.au/__data/assets/pdf_file/0006/314628/ApplicationforaDeferredExamination1.4.pdf (PDF 290KB) for form and further details). If you are ill, you should see a doctor on the day of the examination and the doctor must return the form to the Exams Office within 3 working days of the examination. Please note that having a medical certificate does not guarantee that a deferred examination will be approved.

Students who have completed an examination(s) and who feel that they have been disadvantaged due to illness or other circumstances affecting their study may request special consideration in the marking of their examination(s) (see http://www.utas.edu.au/__data/assets/pdf_file/0019/314623/SpecialConsideration.pdf (PDF 143KB) for form). Forms should be submitted directly to the relevant discipline, accompanied by appropriate supporting documentation, as soon as possible.
after the completion of the examination(s) and no more than 3 working days after completion of the student’s last examination. Granting of special consideration is at the discretion of the lecturer and discipline.

**Penalties**

Students who submit assignment work after the due date (without having obtained an extension by the method specified above) will have the work assessed subject to the following penalty:

- Up to 24 hours after the due date. The assignment will be marked in the usual way and the mark recorded will be 80% of the actual mark obtained.

- More than 24 hours and up to 7 days after the due date. The assignment will be marked in the usual way and the mark recorded will be 50% of the actual mark obtained.

- Later than 7 days after the due date – the assignment will not be marked.

For some internal work it is not possible to accept late assignment submissions. The Unit Coordinator will ensure that it is stated on the description of the assessment task if late submissions will not be accepted. In this case, any work submitted late (without an approved extension) will receive zero marks no matter how late.

**Review of results and appeals**

1. It is expected that students will adhere to the following policy for review of any piece of continuous assessment.

   a. 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.

2. Students may also request a review of the final result in a unit. The request and payment must be made within 10 days from the date of the result notification. Students are referred to Rule of Academic Assessment 111, clause 23 at http://www.utas.edu.au/universitycouncil/universitygovernance/rules and http://www.utas.edu.au/__data/assets/pdf_file/0018/314622/ReviewofAssessment.pdf.
Academic referencing

In your written work you will need to support your ideas by referring to scholarly literature, works of art and/or inventions. It is important that you understand how to correctly refer to the work of others, and how to maintain academic integrity.

The University library provides information on presentation of assignments, including referencing styles and should be referred to when completing tasks in this unit.

Please read the following statement on plagiarism. Should you require clarification please see your unit coordinator or lecturer.

Plagiarism

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. You may also find the Academic Honesty site on MyLO of assistance.

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.

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.

For further information on this statement and general referencing guidelines, see the Plagiarism and Academic Integrity page on the University web site or the Academic Honesty site on MyLO.

Academic misconduct

Academic misconduct includes cheating, plagiarism, allowing another student to copy work for an assignment or an examination, and any other conduct by which a student:
a. seeks to gain, for themselves or for any other person, any academic advantage or advancement to which they or that other person are not entitled; or

b. improperly disadvantages any other student.

Students engaging in any form of academic misconduct may be dealt with under the Ordinance of Student Discipline, and this can include imposition of penalties that range from a deduction/cancellation of marks to exclusion from a unit or the University. Details of penalties that can be imposed are available in Ordinance 9: Student Discipline – Part 3 Academic Misconduct.

**Student Behaviour**

The University Behaviour Policy sets out behaviour expectations for all members of our University community including students and staff.

The aim in doing so is to ensure that our community members are safe, feel valued and can actively contribute to our University mission.

It is expected that community members behave in a manner that is consistent with our University values – respect, fairness and justice, integrity, trust, responsibility and honesty. There are also certain behaviours that are considered inappropriate, such as unlawful discrimination, bullying and sexual misconduct.

The accompanying University Behaviour Procedure sets out the process and avenues that University community members can access to resolve concerns and complaints regarding inappropriate behaviour by a University community member. Wherever possible, the focus will be on early intervention and a ‘restorative’ approach that creates awareness of inappropriate behaviour and its impact on others. However, in some cases, students who engage in inappropriate behaviour may be subject to disciplinary proceedings, which may impact upon continuation of their studies.

Students can seek support and assistance from the Safe and Fair Community Unit SaFCU@utas.edu.au or ph: 6226 2560.

Matters are dealt with in confidence and with sensitivity.
WHAT LEARNING OPPORTUNITIES ARE THERE?

MyLO

MyLO is the online learning environment at the University of Tasmania. This is the system that will host the online learning materials and activities for this unit.

Getting help with MyLO

It is important that you are able to access and use MyLO as part of your study in this unit. To find out more about the features and functions of MyLO, and to practice using them, visit the Getting Started in MyLO unit. For access to information about MyLO and a range of step-by-step guides in pdf, word and video format, visit the MyLO Student Support page on the University website. If something is not working as it should, contact the Service Desk (Service.Desk@utas.edu.au, phone 6226 1818), or Request IT Help Online.

Resources

Required readings

You will need the following text [available from the Co-op Bookshop]:

None Required

Recommended readings

N/A

Reading Lists

Reading Lists provide direct access to all material on unit reading lists in one place. This includes eReadings and items in Reserve. You can access the Reading List for this unit from the link in MyLO, or by going to the Reading Lists page on the University Library website.

Other Required Resources

COMPUTING FACILITIES

The Discipline of ICT has PC labs, Mac labs, 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 ICT Help Desk. If you would like to access these facilities after hours please contact the ICT Help Desk.
USE OF FACILITIES

Use of computing facilities provided by the Discipline of ICT is subject to the Discipline’s Ethics Guidelines, details of which are posted at http://www.utas.edu.au/technologyenvironmentsdesign/ict/currentstudentresources/ethicsguidelines.

Copies of the guidelines are also available in all ICT labs. The Discipline's facilities may only be used for study related purposes, and may not be used for personal gain. Antisocial behaviour in labs such as game playing, viewing pornography, loud discussion, audio without the use of headphones, 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 Discipline’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. You will also be required to complete the relevant MyLO course to gain access. Disciplinary action may be taken against students who violate the guidelines. Details about gaining access to the labs can be found at ICT Reception.

Activities

Learning expectations

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.

**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.**

Details of teaching arrangements

There will be face-to-face lectures in week 1 and 13 to discuss the unit outline and exam revision respectively.

All other lectures will be available online and students are expected to have watched the relevant lectures before their week tutorial.
The will be a two hour tutorial from weeks 2-13. This tutorial will revise some of the lecture material and also involve programming tasks.

**Teaching and learning strategies**

The University is committed to a high standard 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.

**Work Health and Safety (WHS)**

The University is committed to providing a safe and secure teaching and learning environment. In addition to specific requirements of this unit you should refer to the University’s [Work Health and Safety website](#) and policy.

**Communication**

News and announcements will be posted to MyLO News, and students will be expected to be aware of the content of such posts within 48 hours of them being posted.

Generic questions about an assessment task that have not been answered in the descriptions here in the Unit Outline, or in the instructions on MyLO, can be asked using the Discussion Topic named for the specific assessment task. Questions will be responded to within the same Discussion within 72 hours.

Questions specific to an individual assignment may be emailed to the unit coordinator.

**Concerns and complaints**

The University is committed to providing an environment in which any concerns and complaints will be treated seriously, impartially and resolved as quickly as possible. We are also committed to ensuring that a student may lodge a complaint without fear of disadvantage. If you have a concern, information about who to contact for assistance is available on the [How to resolve a student complaint](#) page.
Further information and assistance

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 the unit coordinator in the first instance.

There is a range of University-wide support services available to you including Student Learning Support, Student Advisers, Disability Services, and more which can be found on the Student Support and Development page of the University website.

Should you require assistance in accessing the Library, visit their website for more information.

HELP DESK (DISCIPLINE OF ICT)

Contact the ICT Help Desk if you have any queries or problems with accessing, using, or printing from the computers in the Discipline of ICT 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 to Friday. The phone number is 6226 2929.

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 to 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 ITS please contact the University Help Desk for assistance with these computers.

DISCIPLINE WEBSITE

Discipline of ICT, School of Technology, Environments and Design College of Sciences and Engineering
http://www.utas.edu.au/technologyenvironmentsdesign/ict

COLLEGE WEBSITE

Information and Resources for College of Sciences and Engineering students are available on the College 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/
## Unit schedule

<table>
<thead>
<tr>
<th>WEEK/TOPIC</th>
<th>ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please refer to MyLO for details of topics and activities per week</td>
<td>n/a</td>
</tr>
</tbody>
</table>