School of Engineering and ICT

Discipline of Information and Communication Technology

Unit Outline

KIT205 Data Structures and Algorithms

Semester 1, 2016
Sandy Bay Campus, Hobart
Newnham Campus, Launceston

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UNIT OVERVIEW

Introduction
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).

Prerequisites
KIT107

Unit Weight
12.5% of one academic year

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.

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.

Attendance/performance requirements and teaching and learning strategies
Lectures in this unit will introduce new concepts, but also give you a chance to work through written exercises. Attending lectures will give you the opportunity to ask questions as you work through these exercises.

Laboratory sessions will focus on implementing data structures and algorithms and it is very important that you are familiar with the concepts before the lab. There are MyLO quizzes which are designed to give you some practice working through exercises relevant to the lab.

Communication
News and announcements will be sent via email, and students will be expected to be aware of the content of such posts within 48 hours of them being posted. Assignments will be submitted via MyLO, and assignment results will be posted on MyLO.

Teaching Pattern
Lectures: 3 hr/wk
Tutorials: 1 hr/wk (from week 2)

Unit Content
- Introduction and C-refresher (linked lists)
- Algorithm Analyses and O() refresher
- Trees: Binary Search Trees, Balanced search trees
- Hashing and Heaps
- Sorting Algorithms
- Graph Searching and Shortest Paths
- Minimum Spanning Trees
- Critical Path Analysis and Network Flow
- Algorithm Design Techniques
- Randomised algorithms and data structures
- String algorithms

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

Prior Knowledge and/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.

**Learning Outcomes**

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

You will be an ICT professional with the abilities and skills to:

1. adapt and apply algorithms and data structures for storing, managing and analysing data, information and knowledge;
2. select and effectively apply algorithms and data structures to develop ICT products and services;
3. analyse algorithms and code to determine the runtime (and space) complexity, and evaluate strengths and weaknesses of potential algorithms; and
4. use algorithm design techniques to develop new algorithms for a given problem.

You will acquire attitudes needed by an ICT professional to:

5. take initiative and work independently;
6. communicate effectively using appropriate terminology;
7. use abstraction and computational, creative and critical thinking to problem solve;
8. continue lifelong learning;
9. act in accordance with best practice and industry standards.

**Generic graduate attributes**

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. The course learning outcomes for all the ICT degrees can be found via: [http://www.utas.edu.au/ict/new-courses](http://www.utas.edu.au/ict/new-courses). 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 Quality 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 creative and critical literacies and skills of inquiry. Our graduates recognise and critically evaluate issues of social responsibility, ethical conduct and sustainability. Through respect for diversity and by working in individual and collaborative ways, our graduates reflect the values of the University of Tasmania.

In this unit these skills are specifically targeted:

**Knowledge:** Students will have the opportunity to increase their knowledge of the area of algorithms and to broaden their knowledge of programming by learning a general purpose programming language other than Java. Algorithms and their implementations in programs lie at the heart of the subject of computing.

**Problem-solving skills:** Students will have the opportunity to increase the range of computational problems that they can tackle both through identifying and applying existing algorithms and through identifying and applying algorithm design techniques to create new algorithms.

**Alterations to the unit as a result of student feedback**

Some data structures and algorithms have been removed and the first assignment has been revised to reduce the workload in this unit.
UNIT ASSESSMENT

Assessment Pattern

In-semester (30%), exam (70%)

Assessment Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly quizzes</td>
<td>6%</td>
<td>Monday 9am, weeks 3-12</td>
</tr>
<tr>
<td>First Assignment</td>
<td>12%</td>
<td>26th April (Tuesday, Week 9) at 11:55pm</td>
</tr>
<tr>
<td>Second Assignment</td>
<td>12%</td>
<td>24th May (Tuesday, Week 13) at 11:55pm</td>
</tr>
<tr>
<td>3 hr Examination</td>
<td>70%</td>
<td>The final exam is conducted by the Student Centre in the formal examination period. See the Examinations and Results page: <a href="http://www.utas.edu.au/exams/">http://www.utas.edu.au/exams/</a> on the University's website, or access your personal exams timetable by logging into the eStudent Centre - Personal Exams Timetable: <a href="http://www.studentcentre.utas.edu.au/eStudentCentre/exams/timetable.aspx">http://www.studentcentre.utas.edu.au/eStudentCentre/exams/timetable.aspx</a> for specific date, time and location closer to the examination period.</td>
</tr>
</tbody>
</table>

Assessment Items

**Item 1**

**Title:** Weekly quizzes  
**Type:** In-Semester - learning tasks  
**Task Length:** not applicable  
**Weighting:** 6%  
**Links to Learning Outcomes:** All  
**Due:** Monday 9am, weeks 3-12  
**How To submit:** Submission via MyLO  
**Description:** 10 short MyLO quizzes of equal weight. Most quizzes will require working through algorithms on paper. The quizzes are intended to be useful preparation for the week’s laboratory session and the exam.

**Item 2**

**Title:** First Assignment  
**Type:** In-Semester - individual assignment  
**Task Length:** not applicable  
**Weighting:** 12%  
**Links to Learning Outcomes:** 1-3, 5-9  
**Due:** 26th April (Tuesday, Week 9) at 11:55pm  
**How To submit:** Submission via MyLO  
**Description:** This will be a programming assignment based on material covered in the first 5-6 weeks of lectures.

**Item 3**

**Title:** Second Assignment  
**Type:** In-Semester - individual assignment  
**Task Length:** not applicable  
**Weighting:** 12%  
**Links to Learning Outcomes:** 1-3, 5-9  
**Due:** 24th May (Tuesday, Week 13) at 11:55pm  
**How To submit:** Submission via MyLO  
**Description:** This will be a programming assignment based on material covered in lectures.

**Item 4**

**Title:** 3 hr Examination  
**Type:** Formal Examination  
**Task Length:** 3 hours  
**Weighting:** 70%  
**Links to Learning Outcomes:** All  
**Due:** The final exam is conducted by the Student Centre in the formal examination period. See the Examinations and Results page: http://www.utas.edu.au/exams/ on the University's website, or access your personal exams timetable by logging into the eStudent Centre - Personal Exams Timetable: http://www.studentcentre.utas.edu.au/eStudentCentre/exams/timetable.aspx for specific date, time and location closer to the examination period.  
**Description:** Length: 3 hours  
Materials Permitted: One double sided sheet of A4 paper with handwritten notes to be handed in with examination booklet

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

How your Final Grade will be determined  
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 & communication. This means that you will need to use the Web for this unit. The unit website contains unit information and resources.

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.

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.

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


Online C Tutorial

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 Discipline’s computing labs. If you intend to use software on other computers please check that the versions are compatible.
Microsoft Visual Studio (Free "Community" version available on-line)
GENERAL RESOURCES

School Website

Discipline of ICT, School of Engineering and ICT - Faculty of Science, Engineering, and Technology.
http://www.utas.edu.au/ict

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 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-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-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 Discipline of ICT has PC labs (running Windows 8.1), Mac labs (running Mac OS X 10.10), 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 to collect your account details. If you would like to access these facilities after hours please contact the ICT Help Desk.

In Hobart, there are 4 PC Labs, 2 Mac Labs, and 1 Networks Lab in the Centenary 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 Discipline of ICT is subject to the Discipline's Ethics Guidelines, details of which are posted at http://www.utas.edu.au/ict/resources/ethics-guidelines. 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. 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 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. 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/](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](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](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](http://acserv.admin.utas.edu.au/complaints_info.html)

The Tasmanian University Union (TUU) 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. In addition to specific requirements of this unit you should refer to the University’s Work Health and Safety website - [http://www.utas.edu.au/work-health-safety/](http://www.utas.edu.au/work-health-safety/) and policy.

The University recognises that hazard identification, risk assessment and controls are a critical part of everyday work. Figure 1 shows the risk management process.

Prior to commencing any laboratory and/or field activity on or off campus in this unit you are required to;

- identify hazards - find out what could cause harm
- assess risks if necessary - understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening
- control risks - implement the most effective control measure that is reasonably practicable in the circumstances
- review control measures to ensure they are working as planned.

A formal Risk Assessment must be completed as part of any project proposal/plan prior to commencing any practical activities. Your supervisor will assist you in identifying potential hazards and assessing risks for your project and will assist you with sign off on any documentation.

Use the Risk Assessment template contained within the UTAS Project and Task Risk Management Minimum Standard. A word version of this form is available from the UTAS WHS webpage and in MyLO. Note that risk assessments (RA) are not required for activities that are considered routine and a current Safe Work Procedure (SWP) is already in place to manage the project/task.

For additional advice and assistance see the local WHS Contact or Health and Safety Representative (HSR) within your School/Institution, and/or consult with other staff.
Figure 1. The risk management process (How to Manage Work Health and Safety Risks, Code of Practice, Safe Work Australia)
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


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

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. Failure to appropriately acknowledge the ideas of others constitutes academic dishonesty (plagiarism), a matter considered by the University of Tasmania as a serious offence.

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. You may also find the Academic Honesty site on MyLO of some 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. Details of penalties that can be imposed are available in the Ordinance of Student Discipline - Part 3 Academic Misconduct, see www.utas.edu.au/__data/assets/pdf_file/0006/23991/Ordinance-9-Student-Discipline.pdf.

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."

It is important that you understand this statement on plagiarism. Should you require clarification please see your unit coordinator or lecturer. Useful resources on academic integrity, including what it is and how to maintain it, are also available at: http://www.academicintegrity.utas.edu.au

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 http://www.utas.edu.au/__data/assets/pdf_file/0006/23991/Ordinance-9-Student-Discipline.pdf - Part 3 Academic Misconduct.

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. The University library provides information on presentation of assignments, including referencing styles and should be referred to when completing tasks in this unit. For information on presentation of assignments, including referencing styles: [http://utas.libguides.com/referencing](http://utas.libguides.com/referencing).

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/](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 ICT Help Desk in Launceston and Hobart, and on the Discipline’s web site: [http://www.utas.edu.au/ict/resources](http://www.utas.edu.au/ict/resources).

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 Discipline policy on late assessment. [http://www.utas.edu.au/__data/assets/pdf_file/0003/231960/ExtensionPolicy.pdf](http://www.utas.edu.au/__data/assets/pdf_file/0003/231960/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.
   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/university-council/university-governance/rules](http://www.utas.edu.au/university-council/university-governance/rules) and [http://www.studentcentre.utas.edu.au/examinations_and_results/results/result_review_results.htm](http://www.studentcentre.utas.edu.au/examinations_and_results/results/result_review_results.htm).

**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.

**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.
