MONASH University

FIT2009
Data structures and algorithms

Unit guide

Semester 2, 2008

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FIT2009 Data structures and algorithms - Semester 2 , 2008

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Introduction

Welcome to FIT2009 Data Structures and Algorithms for Semester 2, 2008. This 6 point unit is core in the Applications Development and Networks major of the Bachelor of Information Technology and Systems (BITS) degree. This unit has been designed to provide you understanding of how data is stored to achieve higher efficiency while developing algorithms to solve programming problems in the IT profession. It explores wide range of data structures and algorithms with emphasis on applying the knowledge into programming applications.

Unit synopsis

Algorithm analysis. Application and implementation of some common data structures: stacks, queues, lists, priority queues, tables, sets and collections. Data representations including: arrays, linked lists, heaps, trees (including balanced trees) and hashing. Design of application programs making use of common data structures. Design and implementation of new data structures. Study of advanced algorithms in areas such as: graph theory, pattern searching and data compression. Access to the University's computer systems through an Internet service provider is compulsory for off-campus students

Learning outcomes

1. Ability to analyse simple algorithms to work out an order of magnitude estimate of running time and space.

2. Ability to understand some general algorithm development techniques:

- rescursive algorithms
- divide-and-conquer
- dynamic programming

3. Familiarity with some of the most common data structures:

- stacks
- queues
- lists
- priority queues

4. Ability to implement these data structures using various common data representations:

- arrays
- inked lists
- heaps
- trees (including balanced trees)
- hashing

5. Ability to evaluate which implementation would be most appropriate for a given data structure and application.

6. Ability to apply the same principles used in implementing the common data structures to implement new data structures.

7. Understanding of some more advanced algorithms in areas such as:

- graphs
- data compression

8. Ability to design new algorithms to solve new problems.

9. Enjoyment of programming as an intellectual exercise.

10. Appreciation of the elegance of certain data structures and algorithms as a form of art.

11. Interest in understanding how data structures and algorithms are implemented rather than merely using other people's implementations (and consequently a preference for open source software).

Workload

For on campus students, workload commitments are:

- two-hour lecture;
- two-hour tutorial/laboratory (requiring advance preparation); and
- a minimum of 2-3 hours of personal study per one hour of contact time in order to satisfy the reading and assignment expectations.

You will need to allocate up to 5 hours per week in some weeks, for use of a computer,including time for newsgroups/discussion groups.

Off-campus students generally do not attend lecture and tutorial sessions, however, you should plan to spend equivalent time working through the relevant resources and participating in discussion groups each week.

Unit relationships

Prerequisites

Before attempting this unit you must have satisfactorily completed FIT1007 or equivalent.

Relationships

FIT2009 is a core in the Applications Development and Networks major of the Bachelor of Information Technology and Systems (BITS) degree.

Continuous improvement

Monash is committed to 'Excellence in education' and strives for the highest possible quality in teaching and learning. To monitor how successful we are in providing quality teaching and learning Monash regularly seeks feedback from students, employers and staff. Two of the formal ways that you are invited to provide feedback are through Unit Evaluations and through Monquest Teaching Evaluations.

One of the key formal ways students have to provide feedback is through Unit Evaluation Surveys. It is Monash policy for every unit offered to be evaluated each year. Students are strongly encouraged to complete the surveys as they are an important avenue for students to "have their say". The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

Student Evaluations

The Faculty of IT administers the Unit Evaluation surveys online through the my.monash portal, although for some smaller classes there may be alternative evaluations conducted in class.

If you wish to view how previous students rated this unit, please go to
http://www.monash.edu.au/unit-evaluation-reports/

Over the past few years the Faculty of Information Technology has made a number of improvements to its courses as a result of unit evaluation feedback. Some of these include systematic analysis and planning of unit improvements, and consistent assignment return guidelines.

Monquest Teaching Evaluation surveys may be used by some of your academic staff this semester. They are administered by the Centre for Higher Education Quality (CHEQ) and may be completed in class with a facilitator or on-line through the my.monash portal. The data provided to lecturers is completely anonymous.
Monquest surveys provide academic staff with evidence of the effectiveness of their teaching and identify areas for improvement. Individual Monquest reports are confidential, however, you can see the summary results of Monquest evaluations for 2006 at http://www.adm.monash.edu.au/cheq/evaluations/monquest/profiles/index.html

Unit staff - contact details

Unit leader

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Teaching and learning method

The approach to teaching and learning include a weekly two-hour lecture and a two-hour (tutorial/laboratory). Additionally, each student should spend a minimum of 8 to 12 hours for personal study every week and should allocate up to 5 hours per week in some weeks for use of a computer, including time for newsgroup and discussion.

Communication, participation and feedback

Monash aims to provide a learning environment in which students receive a range of ongoing feedback throughout their studies. You will receive feedback on your work and progress in this unit. This may take the form of group feedback, individual feedback, peer feedback, self-comparison, verbal and written feedback, discussions (on line and in class) as well as more formal feedback related to assignment marks and grades. You are encouraged to draw on a variety of feedback to enhance your learning.

It is essential that you take action immediately if you realise that you have a problem that is affecting your study. Semesters are short, so we can help you best if you let us know as soon as problems arise. Regardless of whether the problem is related directly to your progress in the unit, if it is likely to interfere with your progress you should discuss it with your lecturer or a Community Service counsellor as soon as possible.

Unit Schedule

Week	Topic	Study guide	Key dates
1	Generic Data Structures	1	
2	Algorithm Analysis	2	
3	Developing Algorithms	3	
4	Sorting Algorithms	4	
5	Lists	5	
6	Stacks and Queues	6	
7	Graphs and Trees	7	Assignment 1 due
8	Binary Search Trees	8	
9	Hashing	9	
10	Heaps	10	
11	Some Applications of Data Structures	11	
Mid semester break			
12	Revision		Assignment 2 due

Unit Resources

Prescribed text(s) and readings

Mark Allen Weiss, *Data Structures & Problem Solving using Java*,3rd Edition, Addison Wesley, 2006, ISBN: 0-321-31255-4.

Text books are available from the Monash University Book Shops. Availability from other suppliers cannot be assured. The Bookshop orders texts in specifically for this unit. You are advised to purchase your text book early.

Recommended text(s) and readings

William H. Fordand William R. Topp, *Data Structures with Java*, 2005, Pearson Education International, ISBN 0131293370

Lafore, R, *Data Structures & Algorithms in Java*,2nd edition, 2002, SAMS, ISBN 0-672-32453-9

Robert Sedgewick and Michael Schidlowsky, *Algorithmsin Java*, 3rd edition (Parts 1-4), Addison Wesley, 2002, ISBN:0201361205.

Mitchell Waite and Robert Lafore, *Data Structures & Algorithms in Java*, Waite Group Press, 1998, ISBN: 1571690956.

Donald Ervin Knuth, *Art of Computer Programming, Volume 1: Fundamental Algorithms*, 3rd edition, Addison Wesley, 1997, ISBN:0201896834.

Donald Ervin Knuth, *Art of Computer Programming, Volume 3: Sorting and Searching*, 2nd edition, Addison Wesley, 1998, ISBN:0201896850.

Required software and/or hardware

Java SE JDK version 1.5 (also known as version 5) or later.

This software is included in the GSIT Unit Software CD-ROM, which will be sent to all students.

The software may also be downloaded free from http://java.sun.com

Equipment and consumables required or provided

Students studying off-campus are required to have the minimum system configuration specified by the Faculty as a condition of accepting admission, and regular Internet access. On-campus students, and those studying at supported study locations may use the facilities available in the computing labs. Information about computer use for students is available from the ITS Student Resource Guide in the Monash University Handbook. You will need to allocate up to **8** hours per week for use of a computer, including time for newsgroups/discussion groups.

Study resources

Study resources we will provide for your study are:

- A Unit Book containing 11 study guides at MUSO.
- This Unit Information outlining the administrative information for the unit.

- A CD-ROM (possibly sent at the start of the year if you were enrolled in a first semester unit that required it) with software required for all units (this includes all the software required to complete this unit).
- A unit web page at MUSO where lecture slides, weekly tutorial requirements, assignment specifications, sample solutions and supplementary material will be posted.
- Discussion groups at MUSO.

Library access

The Monash University Library site contains details about borrowing rights and catalogue searching. To learn more about the library and the various resources available, please go to http://www.lib.monash.edu.au. Be sure to obtain a copy of the Library Guide, and if necessary, the instructions for remote access from the library website.

Monash University Studies Online (MUSO)

All unit and lecture materials are available through MUSO (Monash University Studies Online). Blackboard is the primary application used to deliver your unit resources. Some units will be piloted in Moodle. If your unit is piloted in Moodle, you will see a link from your Blackboard unit to Moodle (http://moodle.monash.edu.au) and can bookmark this link to access directly. In Moodle, from the Faculty of Information Technology category, click on the link for your unit.

You can access MUSO and Blackboard via the portal: http://my.monash.edu.au

Click on the Study and enrolment tab, then Blackboard under the MUSO learning systems.

In order for your Blackboard unit(s) to function correctly, your computer needs to be correctly configured.

For example:

- Blackboard supported browser
- Supported Java runtime environment

For more information, please visit: http://www.monash.edu.au/muso/support/students/downloadables-student.html

You can contact the MUSO Support by: Phone: (+61 3) 9903 1268

For further contact information including operational hours, please visit:
http://www.monash.edu.au/muso/support/students/contact.html

Further information can be obtained from the MUSO support site:
http://www.monash.edu.au/muso/support/index.html

Assessment

Unit assessment policy

The unit is assessed with two assignments and a three hour closed book examination. To pass the unit you must:

- attempt both assignments and the examination
- achieve no less than 40% of the possible average marks in the two assignments
- achieve no less than 40% of the possible marks in the exam
- achieve no less than 50% of possible marks

Assignment tasks

- **Assignment Task**

  Title : Assignment 1

  Description :

  Students will be required to perform a number of tasks involving both analytical and practical (computer programming) skills from the syllabus covered in Study Guides 1-4.

  Weighting : 20%

  Criteria for assessment :

  The specification and marking criteria will be released in MUSO four teaching weeks in advance of the due date. Solutions will be released after the cut-off date, which is one week after the due date.

  Due date : 25 August 2008
- **Assignment Task**

  Title : Assignment 2

  Description :

  Students will be required to perform a number of tasks involving both analytical and practical (computer programming) skills from the syllabus covered in Study Guides 5-8.

  Weighting : 20%

  Criteria for assessment :

  The specification and marking criteria will be released in MUSO four teaching weeks in advance of the due date. Solutions will be released after the cut-off date, which is one week after the due date.

  Due date : 6 October 2008

Examinations

- **Examination**

  Weighting : 60%

  Length : 3 hours

  Type (open/closed book) : Closed book

Assignment submission

Assignments will be submitted electronically via MUSO.

Assignment coversheets

No coversheet needed. Assignments at MUSO will be released to invidual student condition to successfully completing a plagiarism declaration.

University and Faculty policy on assessment

Due dates and extensions

The due dates for the submission of assignments are given in the previous section. Please make every effort to submit work by the due dates. It is your responsibility to structure your study program around assignment deadlines, family, work and other commitments. Factors such as normal work pressures, vacations, etc. are seldom regarded as appropriate reasons for granting extensions. Students are advised to NOT assume that granting of an extension is a matter of course.

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- Requests for extensions must be made by email **at least two days** before the due date. You will be asked to forward original medical certificates in cases of illness, and may be asked to provide other forms of documentation where necessary.
- Contact the Unit Adviser by email to request extensions.

Late assignment

- An assignment must be submitted by the *cut-off* date, which is usually seven days after the due date. Any assignment submitted after the cut-off date will not be accepted by the MUSO system and therefore, it will be marked automatically to zero.
- Any assignment submitted after the due date will be penalised by 5% of the full marks for each 24 hours of delay.
- This policy is strict because comments or guidance will be given on assignments as they are returned, and sample solutions may also be published and distributed, after assignment marking or with the returned assignment.

Return dates

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

Assessment for the unit as a whole is in accordance with the provisions of the Monash University Education Policy at http://www.policy.monash.edu/policy-bank/academic/education/assessment/

We will aim to have assignment results made available to you within two weeks of the cut-off date.

Plagiarism, cheating and collusion

Plagiarism and cheating are regarded as very serious offences. In cases where cheating has been confirmed, students have been severely penalised, from losing all marks for an assignment, to facing disciplinary action at the Faculty level. While we would wish that all our students adhere to sound ethical conduct and honesty, I will ask you to acquaint yourself with Student Rights and Responsibilities (http://www.infotech.monash.edu.au/about/committees-groups/facboard/policies/studrights.html) and the Faculty regulations that apply to students detected cheating as these will be applied in all detected cases.

In this University, cheating means seeking to obtain an unfair advantage in any examination or any other written or practical work to be submitted or completed by a student for assessment. It includes the use, or attempted use, of any means to gain an unfair advantage for any assessable work in the unit, where the means is contrary to the instructions for such work.

When you submit an individual assessment item, such as a program, a report, an essay, assignment or other piece of work, under your name you are understood to be stating that this is your own work. If a submission is identical with, or similar to, someone else's work, an assumption of cheating may arise. If you are planning on working with another student, it is acceptable to undertake research together, and discuss problems, but it is not acceptable to jointly develop or share solutions unless this is specified by your lecturer.

Intentionally providing students with your solutions to assignments is classified as "assisting to cheat" and students who do this may be subject to disciplinary action. You should take reasonable care that your solution is not accidentally or deliberately obtained by other students. For example, do not leave copies of your work in progress on the hard drives of shared computers, and do not show your work to other students. If you believe this may have happened, please be sure to contact your lecturer as soon as possible.

Cheating also includes taking into an examination any material contrary to the regulations, including any bilingual dictionary, whether or not with the intention of using it to obtain an advantage.

Plagiarism involves the false representation of another person's ideas, or findings, as your own by either copying material or paraphrasing without citing sources. It is both professional and ethical to reference clearly the ideas and information that you have used from another writer. If the source is not identified, then you have plagiarised work of the other author. Plagiarism is a form of dishonesty that is insulting to the reader and grossly unfair to your student colleagues.

Register of counselling about plagiarism

The university requires faculties to keep a simple and confidential register to record counselling to students about plagiarism (e.g. warnings). The register is accessible to Associate Deans Teaching (or nominees) and, where requested, students concerned have access to their own details in the register. The register is to serve as a record of counselling about the nature of plagiarism, not as a record of allegations; and no provision of appeals in relation to the register is necessary or applicable.

Non-discriminatory language

The Faculty of Information Technology is committed to the use of non-discriminatory language in all forms of communication. Discriminatory language is that which refers in abusive terms to gender, race, age, sexual orientation, citizenship or nationality, ethnic or language background, physical or mental ability, or political or religious views, or which stereotypes groups in an adverse manner. This is not meant to preclude or inhibit legitimate academic debate on any issue; however, the language used in such debate should be non-discriminatory and sensitive to these matters. It is important to avoid the use of discriminatory language in your communications and written work. The most common form of discriminatory language in academic work tends to be in the area of gender inclusiveness. You are, therefore, requested to check for this and to ensure your work and communications are non-discriminatory in all respects.

Students with disabilities

Students with disabilities that may disadvantage them in assessment should seek advice from one of the following before completing assessment tasks and examinations:

- Faculty of Information Technology Student Service staff, and / or
- your Unit Coordinator, or

- Disabilities Liaison Unit

Deferred assessment and special consideration

Deferred assessment (not to be confused with an extension for submission of an assignment) may be granted in cases of extenuating personal circumstances such as serious personal illness or bereavement. Information and forms for Special Consideration and deferred assessment applications are available at http://www.monash.edu.au/exams/special-consideration.html. Contact the Faculty's Student Services staff at your campus for further information and advice.