FIT2014
Theory of computation

Unit guide

Semester 2, 2008

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FIT2014 Theory of computation - Semester 2 , 2008

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Introduction

Welcome to FIT2014 *Theory of Computation*.

The following guide is given so that you can have a productive semester and you can complete the unit successfully.

Unit synopsis

This subject looks at the question of exactly what a computer can compute, and gives an introduction to formal languages. Topics include computable functions, finite state automata, regular expressions, grammars, translators, and Turing computability.

Learning outcomes

Knowledge and Understanding

At the completion of this unit, you will have an understanding of:

- How to describe languages using Regular Expressions, Finite Automata, Nondeterministic Finite Automata, Mealy Machines, Moore Machines, Context Free Grammars, Pushdown Automata, and Turing Machines.
- The relationship between Regular Languages, Context Free Languages, Recursive Languages, and Recursive-Enumerable (or Computable) Languages.
- How to use Turing Machines to represent computable functions.
- How a Universal Turing machine can simulate any Turing Machine on any input.
- Knowledge of compiler generation tools and the ability to use these to create simple compilation/translation programs.

Attitudes, Values and Beliefs

At the completion of this unit, you will be able to:

- Appreciate the limitations of Regular Languages, Context Free Languages, Recursive Languages, and Computable Languages.
- Comprehend the limitations of computers in terms of the problems they can solve.

Practical Skills

At the completion of this unit, you will be able to:

- Construct Finite Automata, Nondeterministic Automata, and Turing Machines to describe languages.
- Use Finite Automata to construct lexical analysers.
- Use lexical analyser generator to construct lexical analysers.
- Convert Regular Expressions into a Finite Automata.
- Convert Finite Automata into Regular Expressions.
- Use a compiler complier to construct parsers.
- Find a Regular Grammar for a Regular Language.
- Find a parse tree, leftmost derivation and rightmost derivation for a word in a Context Free Language.
- Know how to show a Context Free Grammar is ambiguous.
- Convert Mealy Machines and Moore Machines into sequential logic circuits.

Workload

Average of 12 hours per week: 2 hours lecture, either 1 hour tutorial or 3 hour laboratory, and 8 hours of reading, working on exercises and assignment, etc.

Unit relationships

Prerequisites

Prerequisite Units (20080116100435)

FIT1008 or FIT1015 (or CSE1303).

- 2 of MAT1841 Mathematics for Computer Science I, MAT1830 Mathematics for Computer Science II (or equivalent), MTH1020 Analysis of change, MTH1030 Techniques for modelling, MTH1112 Numbers, logic and graphs or MTH2010 Multivariable calculus, or
- one of MAT1841 Mathematics for Computer Science I and MAT1830 Mathematics for Computer Science II (or equivalent) as a pre-requisite, while the other is taken as a co-requisite.

Prerequisite Knowledge

Students beginning FIT2014 Theory of Computation are assumed to be able to program either in Java or C.

Relationships

This is a second year core unit in BCS, BSE, BCS/BA, BCS/LLB, and BSc/BCS, and is a second year core unit in a computer science major in BSc. It introduces students to the formal theory of languages, lexical analysers, compilers, and the limitations of what computers can compute.

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

Improvements to this unit

The major change relates to a change in the Learning Management System: we will use Moodle rather than the old Blackboard Vista. This change comes as a result of the number of student complaints regarding the problems in using Blackboard. As a result, we would like to ask students for feedback regarding the ease of use of Moodle and the adequacy of its capabilities.

The unit coordinator is planning to run a Monquest evaluation in the latter part of the semester.

Unit staff - contact details

Unit leader

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Lecturer(s) :

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Dr Mohammed Belkhatir

Teaching and learning method

You are expected to read through the prac notes before each prac class, and to perform the preparatory tasks described in the notes. *Please ask your lecturer before your prac if you do not understand the requirements for the prac.*

Most prac work is designed so that most students *cannot* start and finish it in three hours. You must devote considerable thought to the prac work prior to attending the prac, and ideally you should have code already written for a substantial portion of the prac *prior to attending it*. The prac should be used to seek assistance with respect to unresolved issues, to finalize programs, and to debug and test your programs.

If you have trouble preparing for the prac you should seek assistance concerning requirements and approaches to the problem from tutors or lecturers during consultation hours.

Tutorial allocation

All students need to register for tutorials/laboratories using Allocate+, http://allocate.cc.monash.edu.au/.

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	References/Readings	Key dates
1	Regular Languages	Cohen: Chapters 1-4	
2	Finite Automaton	Cohen: Chapters 5-7	
3	Lexical Analysis	Aho et al.: Chapter 3	
4	Kleene's Theorem	Cohen: Chapters 7,8	
5	Context Free Grammars	Cohen: Chapters 10, 12	
6	Parsing	Aho et al.: Sections 4.2 & 4.3	
7	Rewriting Grammars	Aho et al.: Chapter 1	
8	Predictive Parser	Aho et al.: Section 4.4	
9	Compiler-Compilers	Aho et al.: Section 4.4	
10	Turing Machines	Cohen: Chapters 13-16,19	
11	Computability	Cohen: Chapters 23,25	
Mid semester break			
12	Decidability	Cohen: Chapter 23	

13	Godel Incompletness Theorem		

Unit Resources

Prescribed text(s) and readings

Daniel I.A. Cohen, "*Introduction to Computer Theory*", Second Edition, John Wiley & Sons, Inc. 1997.

Recommended text(s) and readings

Michael Sipser, "*Introduction to the Theory of Computation*", PWS Publishing Company, 1997

A.V. Aho, M.S. Lam, R. Sethi and J.D. Ullman. "*Compilers: Principles, Techniques and Tools*", 2nd edition, Addison-Wesley, 2007.

Required software and/or hardware

You will need access to:

- Cup available via: http://www2.cs.tum.edu/projects/cup/
- Jflex available via: http://jflex.de/

Study resources

Study resources we will provide for your study are:

Study resources we will provide for your study are:

- Weekly detailed lecture notes;
- Tutorial execises and laboratory tasks;
- Tutorial solutions two weeks later;
- Access to past examination papers;
- Discussion groups;
- This Unit Guide outlining the administrative information for the unit;
- The unit web site on MUSO, where resources outlined above will be made available.

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

In order to pass this unit you must:

- Obtain at least 50% on the exam.
- Obtain at least 50% overall for your pracs.
- Attend four out of the five pracs this semester.
- Obtain an overall mark of at least 50%.

If you do not meet all of the above conditions the highest mark you can receive is 44N

Assignment tasks

- ### Assignment Task

  Title : Pracs (3 hours)

  Description :

  Each week you will need to complete a prac assignment. Prac assignments are long and are designed to take a significant part of your ``home study hours''. This means that you must have a significant proportion of the prac completed before attending the scheduled computer lab. The aim of the computer lab practical is to iron out any bugs, ask any questions about the prac you have not been able to solve on your own, improve the parts that your demonstrator points out as lacking (including comments, algorithms, etc), and get your prac marked. If you do nothing before the scheduled prac, you will soon realise that you do not have enough time to complete it.

  The prac sheets will be released every Thursday morning and made available in the unit's web page.

  Weighting : 30%

  Criteria for assessment :

  Every prac sheet contains the assessment criteria used to assess that prac. In addition, demonstrators carry with them a marking guide prepared by the lecturer which indicates how exactly mark each prac question. You can request the demonstrator to show you the marking guide after he/she has marked your prac.

  Due date :

  Remarks (optional - leave blank for none) :

  There are two hurdles associated to the pracs. First, you must attend at least 4 out of the 5 pracs. Second, you must score at least 50% of the prac mark. A student who does not meet all these hurdles can get a maximum of 44 N for the unit.

Examinations

- **Examination**

  Weighting : 70%

  Length : 3 hours

  Type (open/closed book) : Closed book

  Remarks (optional - leave blank for none) :

  There is a hurdle associated with the exam mark: you must score at least 50% of the exam mark. Furthermore, you must score at least 50% overall.

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.

If for any valid reason you cannot attend your usual prac and would like to attend a different prac, you need to email cl-fit2014-admin@infotech.monash.edu.au and ask for permission. In doing this you must provide:

- Your name:
- Your ID number:
- Regular Prac: (time and room)
- The reason you cannot attend your usual prac.
- The details (time and room) of the prac you would like to attend

Late assignment

If you miss a prac or tutorial class for any reason you *must* do the following to obtain an exemption for the missed class:

- Submit an absentee form no more than one week after you return to University. These forms are available from and should be handed in to the General office (Clayton) in building 63.
- Attach any documentary evidence, for example, medical certificate covering the date of your missed class, letter of explanation, police report or plane boarding pass.

Failure to do the above will result in you being marked absent for the class and receiving zero marks. Exemptions will not be granted automatically, and will be considered on a case by case basis. You are also only allowed one exemption a semester for this unit.

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/

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.