SUBJECT OUTLINE

UNIVERSITY OF TECHNOLOGY SYDNEY

31251 Data Structures and Algorithms

Course area UTS: Engineering and Information Technology

Delivery Autumn 2011;City

Credit points 6cp

Requisite(s) 31244 Applications Programming OR 31469 Object-oriented Design OR 31488 Programming Foundations OR 31508 Programming Fundamentals OR 48024 Object-oriented Design

Result type Grade and marks

Recommended studies: basic programming concepts: variables, loops and decisions;
basic file manipulation in UNIX: directories and files, editing files, re-direction; basic understanding of the standard Von Neumann computer model: the fetch-execute cycle, single memory with byte addressing, input and output with disks, keyboard and screen; understanding of character sets and internal data representations, including ASCII, signed integers, floating point

Subject coordinator

Gordon Lingard
Room: CB10.4/559
Phone: 9514-7935
Email: glingard@it.uts.edu.au

Please note. Please do not send email in HTML format or with attachments. They will not be read or opened. Only emails sent in plain text format will be read. In addition, you must include a subject header with your email. Emails without subject headers are automatically deleted as junk email. In general, if you have questions about the subject material, labs or the assignments then please use UTS Online and ask them there.

Subject description

This subject teaches students how to design, develop and evaluate data structures and algorithms to meet predefined quality characteristics of functionality (suitability) and usability (understandability, learnability, operability, compliance). Software solutions are implemented using C++. Concepts, theories and technologies underlying the methods and techniques are introduced and explained as required.

Subject objectives

On successful completion of this subject the student will be able to:

1. Code and test well-structured programs of moderate size using the C++ language.
2. Understand basic data structures and algorithms for manipulating them.
3. Understand the principles of good program design and how they are applied to the C++ language.
4. Contribute to software quality through skills in formatting, debugging and testing programs.

Contribution to course aims and graduate attributes

This subject builds on the material learned in 31244 Application Programming. In particular, it introduces the student to a new programming language and to the more advanced concepts of data
structures and algorithms. On both fronts this broadens the student's programming knowledge (GA 4.2, GA 4.4). Through its practical components in the lab exercises and the formative and summative assessment tasks supported by an instant feedback system, it demonstrates the ability to work in a self-reliant and independent way (GA 2). It also further develops the professional attributes of being able to relate concepts learned in the course to an industrial or business environment (GA 5) and critical thinking (GA 7).

Content

1. C++ constructs including templates and the STL

2. Program design
3. Design, implementation, and evaluation of data structures
4. Design, implementation, and evaluation of algorithms
5. Recursion
6. Computability, NP-Completeness, Optimization

Program

Week/Session	Dates	Description
1	1 March	Introduction, C++
2	8 March	Functions, arrays, pointers
3	15 March	Strings, I/O **Notes:** Assign 1 released
4	22 March	Classes
5	29 March	Templates, Vector
6	5 April	Lists
7	12 April	Algorithms, recursion, STL **Notes:** Assign 2 released
8	19 April	Non-teaching Week
-	26 April	VC Week
9	3 May	Trees **Notes:** Assign 2 due
10	10 May	Hashing **Notes:** Assign 3 released

11	17 May	Sorting
12	24 May	String searching
13	31 May	NP Complete, Optimization **Notes:** Assign 1 assessed in the laboratory this week Assign 2 due
14		

Additional information

Compilers

To learn programming, you must write programs. The class notes and independent learning modules assume you will be using the g++ compiler. You can also use Sun's cc compiler on the Faculty's UNIX machines (i.e., the support system available in the directory /opt/SUNWspro/bin). In particular, when you submit an assignment for marking, your program will be compiled and tested using both compilers

If you want to prepare and test programs using your own computer, you will have to obtain your own C++ compiler and run-time system. There are many factors involved in choosing a compiler: the main ones are cost, platform and what else you think you might do with the compiler afterwards. There are many systems available and students have very different goals, so it is not possible to state which particular product is "best". If you have a PC and do not wish to purchase a compiler, you can down load a free one from

http://www.borland.com/bcppbuilder/freecompiler

In this subject we emphasise the use of standard, portable C++ constructs. Correct programs using standard constructs will run on any system. However, it is possible to have a program that appears correct in one environment but shows errors in another system. This is most often because of insufficient testing. A particular problem is that personal computers do not do as much checking of memory references as UNIX systems, so incorrect pointer usage is more likely to cause program crashes in a UNIX environment than in a PC environment.

Remember that your programs will be tested for marking purposes on the Faculty's UNIX system, and please, do not try for more marks with the argument "but that fault didn't show up on my computer."

Academic Standards

Students are reminded of the principles laid down in the Faculty's Statement of Academic Integrity - Good Practice and Ethics in Informal Assessment found at;

wiki.it.uts.edu.au/start/Academic_Integrity

The University's rules regarding academic misconduct can be found at; *www.gsu.uts.edu.au/rules/16-2.html* Assignments in this Subject should be your own original work. The inclusion in assessable work of any material such as code, graphics or essay text obtained from other persons or sources without citation of the source is plagiarism and is a breach of University Rule 16.2.2.

Any collaboration with another person should be limited to those described in the "Acceptable Behaviour" section of the Statement of Academic Integrity. Similarly, any group work should be the result of collaboration only within the group. Any infringement by a student will be considered a breach of discipline and will be dealt with in accordance with the Rules and By-Laws of the University.

Please Note. There is no group work within this subject.

Students are not to give to or receive from any other persons copies of their assessable work in any form (hard copy or an electronic file). To do so is 'academic misconduct' and is a breach of University Rule 16.2.2. That is, assisting other students to cheat or to act dishonestly in a submitted assignment.

Accidental submission of another students work as your own is considered to be a breach of University Rule 16.2.2 in that you are acting dishonestly since you should not have a copy of another student's work.

The Faculty penalty for proven and serial misconduct of this nature is zero marks for the Subject. For more information go to;
wiki.it.uts.edu.au/start/Academic_Integrity .

Please Note. Assignment submissions will be checked by a sophisticated array of plagiarism detection software. This software was first used in Autumn semester 2001 and resulted in a significant number of prosecutions of copying, collusion and plagiarism within this subject.

ELSSA

If you think you need help with your English, or feel unable to express yourself correctly in assignments, contact the English Language Study Skills Assistance (ELSSA) Centre, Level 18 Tower Building, Broadway, phone 9514-2327.

ALO

Academic Liaison Officers' (ALO) are academics who help students with special needs (students with temporary or permanent disabilities, students with language problems who are from non-English speaking backgrounds, or students who are primary carers).

If you require assistance with assessment tasks and exams, the Faculty ALO will help you negotiate special conditions with your Lecturers. For example;

• the use of a dictionary and extra time in exams if your first language is not English (only available for your first two years at UTS)
• tests and exams printed in larger type if you have a vision impairment
• use of a lap-top if you cannot write because of an injury
• extra time to complete assignments if your studies have been disrupted by illness or disability.

If you require it, the ALO will talk to all your Lecturers so that you don't have to explain your circumstances to each of them individually. Privacy is important and personal information is only passed on to university staff on a "need to know" basis. Students with disabilities are encouraged to contact the Special Needs Service for advice before contacting the ALO.

The contact details for the Faculty ALO's can be found at:
www.ssu.uts.edu.au/sneeds/services/assessment/alo.html

Student Support

Information regarding support available to students undertaking this Subject is available at;
wiki.it.uts.edu.au/start/Student_Support
Support for learning and teamwork skills is available at; *www.bell.uts.edu.au* and *www.star.uts.edu.au*

You should attempt to resolve the problem through the following chain: 1. Tutor, 2. Lecturer, 3. Subject Coordinator, 4. Head of School, and finally 5. the Responsible Academic Officer, (Associate Dean Teaching and Learning)

Additional subject costs

The lecture notes will be available for sale in the Union Shop on level 3 of the UTS Tower for $15 (purchase number: CN3878).

Assessment

Assessment item 1: Laboratory Exercise

Objective(s): 1 and 4

Weighting: 9%

Due: Laboratories start in week 2. From week 3 each laboratory will be submitted for marking. There are 9 submit-able laboratories each worth 1%.

Each of the submit-able laboratories will be made available on the working day before the laboratory and be due at 11.59pm on the day before the next laboratory. Late laboratories will not be accepted.

Each laboratory exercise will be in the form of a small program you have to debug and possibly add some extra code to. The exercise will be based upon the previous weeks lecture material.

You will submit the laboratories using a online submission system. The laboratory specification will give full details about how this is done.

Task: The laboratory exercises can be found at: /pub/prprog/labs

Further information: The only way to really learn programming is to do it and constantly practice. For this reason the laboratories have been set up to encourage you to practice.

Assessment item 2: Programming Assignment 1

Weighting: 11%

Due: Assignment 1 released in week 3, beginning of lecture. Assignment 1 due in week 13, Laboratory.

You will submit the assignment using a online submission system. The assignment specification will give full details about how this is done.

Task: Working indivually or in pairs, you will modify a program to add additional capability.

Further information:

Objectives:

This assignment helps students develop all the objectives.

Group Work:

This assignment may be done individually or in groups of 2. Details will be given in the assignment specification.

Assignment Extensions:

This assignment will be assessed in the laboratory for week 13. There are no extensions possible for this assessment. If you cannot attend the laboratory, you must contact the Subject Coordinator to nominate a proxy for you. Details will be given in the assignment specification.

Missing Assignments:

If you miss any piece of assessment through documented illness or misadventure, you should consult with the Subject Coordinator.

Assessment item 3: Programming Assignment 2

Weighting: 15%

Due: Assignment 2 released in week 7, beginning of lecture. Assignment 2 due in week 9, 11.59pm, Friday.

You will submit the assignment using a online submission system. The assignment specification will give full details about how this is done.

Further information:

Objectives:

This assignment helps students develop all the objectives.

Group Work:

There is no group work in this assignment

Late Assignment:

Students are cautioned that assignment deadlines will be strictly adhered to in this subject. If the assignment is late by less than one week it will incur a penalty of 5% of the maximum assignment mark for each day or part thereof late. The Assignment will not be accepted a week after the due date. An extension of one week will be granted if there is a fully documented reason that merits it. The documentation must be presented to the Subject Coordinator before the assignment due date.

Assignment Extensions:

Extensions longer than a week will not be granted under any circumstances as the assignment solution will have been made available by then. If a one week extension is granted that means the assignment will be accepted up to a week after the due date without penalty. It will not be accepted later than that.

Missing Assignments:

If you miss doing the assignment through documented illness or misadventure, you should consult with the Subject Coordinator.

Assessment item 4: Programming Assignment 3

Weighting: 25%

Due: Assignment 3 released in week 10, beginning of lecture Assignment 3 due in week 13, 11.59pm, Friday

You will submit the assignment using a online submission system. The assignment specification will give full details about how this is done.

Further information: Please read **Further Information** for assignment 2

Assessment item 5: Final Examination

Weighting: 40%

Task: The final examination will be held in the usual examination time. It will cover the whole semester's work, including all the objectives, and be a closed book, 3 hour multiple choice question exam.

Further information:

Objectives:

This exam covers all of the objectives.

Missing the Exam:

If you miss the exam through documented illness or misadventure, you should consult with the Subject Coordinator. Additionally, your "Application for Alternative Examination (due to Illness or Misadventure)" form must be submitted with appropriate documentation to the Student Information & Administration Centre within three working days of the examination. If you fail to attend the alternate exam no other arrangements will be made and you will receive zero for the exam.

Supplementary Exam:

Under the University's Assessment Policy no supplementary examination is required in this subject

and none shall be offerred.

Minimum requirements

In order to pass the subject you must attain all of the following minimum requirements

1. Minimum of 16 out of 40 (40%) in the final exam.
2. Minimum of 50 out of 100 (50%) in the overall mark

If you fail to achieve the first requirement then the mark you will be awarded is either your overall mark or 44, whichever is the lower, and a grade of Z.

Recommended texts

Elliot B. Koffman & Paul A.T. Wolfgang
Objects, Abstraction, Data Structures and Design Using C++
John Wiley & Sons, Inc
ISBN 0-471-46755-3

Indicative references

S. Lippman, J. Lagoie & B. Moo
C++ Primer - 4th Edition.
Probably the main reference book around on C++. Most C++ programmers would have a copy of this on their bookshelf

N. Josuttis
The C++ Standard Library: A Tutorial and Reference
A very useful book that goes into the details of the STL.

Online References
http://www.cppreference.com/
http://www.cplusplus.com/

Other resources

Computer account

You will need to have a student computer account with the Faculty of Engineering and Information Technology. If you are a faculty student you will already have one. If you are a non-faculty student you will need to ensure you have one. If you are unsure, or need to arrange an account, then you can contact the Technical Support Help Desk – Building 10, Room 3.370 Phone 9514-1869.

Course material

Material related to the course will be made available on the student server in the following directory. /pub/prprog
Materials will also be available via the web. The URL is as follows.
https://learn.it.uts.edu.au/dsa/

UTS Online

This subject makes extensive use of UTS Online, particularly the discussions boards. Students are strongly encouraged to make use of the discussion boards to ask questions to help with their learning. Furthermore, information about the subject will be posted in the anouncements section of UTS Online. You must check UTS Online at least once a week for any subject updates.

Disclaimer

This outline serves as a supplement to the Faculty of Engineering and Information Technology Student Guide. On all matters not specifically covered in this outline, the requirements specified in the Student Guide apply.