Faculty of Information and Communication Technologies

Higher Education

Unit of Study Outline

HIT3303

Data Structures and Patterns

Semester 1, 2011
Unit of Study Outline

<table>
<thead>
<tr>
<th>Unit of study code</th>
<th>HIT3303</th>
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<tbody>
<tr>
<td>Unit of study name</td>
<td>Data Structures and Patterns</td>
</tr>
<tr>
<td>Teaching Term/Semester &amp; Year</td>
<td>Semester 1, 2011</td>
</tr>
<tr>
<td>Contact Hours (hrs/wk) or total contact hours</td>
<td>4</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>HIT1052 Software Development 2, HIT2302 Object-Oriented Programming, or HIT3037 Programming in Java</td>
</tr>
<tr>
<td>Corequisites</td>
<td></td>
</tr>
<tr>
<td>Credit Points</td>
<td>12.5</td>
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</tbody>
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Aims

HIT3303 – Data Structures and Patterns studies the design, implementation, and application of data structures as a means for algorithmic problem solving. Each problem exhibits specific characteristics with respect to resource requirements, data representation, and software architecture. The study of data structures is primarily concerned with the following questions:

- How can a given problem be effectively expressed?
- What are suitable data representations for specifying computational processes?
- What is the impact of data and its representation with respect to time and space consumption?
- What are the reoccurring structural artefacts in software and how can we identify them in order to facilitate problem solving?

Learning Objectives

After successfully completing this unit, you should be able to:

1. Solve problems using object oriented design and implementation techniques.
2. Interpret the tradeoffs and issues involved in the design, implementation, and application of various data structures with respect to a given problem.
3. Design, implement, and evaluate software solutions using behavioural, creational, and structural software design patterns.
4. Explain the purpose and answer questions about data structures and design patterns that illustrate strengths and weaknesses with respect to resource consumption.
5. Assess the impact of data structures on algorithms.
Content

• Introduction
  o Basic concepts
  o Sets, arrays, indexer, and iterators
  o Asymptotic algorithm analysis

• Fundamental Data Structures
  o Dynamic arrays
  o Single-linked lists

• Data Types and Abstraction
  o Abstract data types
  o Design patterns
  o Pointers
  o Memory management

• Basic Container Types
  o Stacks
  o Queues
  o Ordered lists
  o Hash tables

• Hierarchical Data Types
  o Trees
  o Graphs
  o Tree traversals

• Algorithmic Patterns and Problem Solvers
  o Basics
  o Performance analysis
  o Greedy algorithms
  o Backtracking
  o Divide-and-Conquer

Learning and Teaching Structure

Lecture (2 hours per week): Wednesday 10:30 – 12:30, EN213.
Laboratory (2 hours per week): Wednesday 08:30 – 10:30, ATC625,
                             Wednesday 12:30 – 14:30, ATC621, or
                             Thursday 09:30 – 11:30, EN305.

In a Semester, you should normally expect to spend, on average, twelve and a half hours of total
time (formal contact time plus independent study time) a week on a 12.5 credit point unit of study.

The semester is organized in two blocks: February 28 – April 22, 2011 and May 2 – May 27, 2011.
The mid-semester break (Easter) is scheduled to occur between April 25 and April 29, 2011.

Teaching Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Campus &amp; Room No.</th>
<th>Phone No.</th>
<th>Email Address</th>
<th>Consultation Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Markus Lumpe</td>
<td>Convenor</td>
<td>EN508c EN514d</td>
<td>5272</td>
<td><a href="mailto:mlumpe@swin.edu.au">mlumpe@swin.edu.au</a></td>
<td>By appointment</td>
</tr>
</tbody>
</table>
Resources and Reference Material

- Bruno R. Preiss: Data Structures and Algorithms with Object-Oriented Design Patterns in C++/Java/C#/.Net/Python/Ruby.
- Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, Design Patterns.
- Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, and Michael Stal, Pattern-Oriented Software Architecture: A System of Patterns.
- Kenneth A. Berman and Jerome L. Paul: Algorithms: Sequential, Parallel, and Distributed.
- Richard F. Gilberg and Behrouz A. Forouzan: Data Structures - A Pseudocode Approach with C.
- Harold Abelson et al.: Structure and Interpretation of Computer Programs.
- Peter Drayton, Ben Albahari, and Ted Neward: C# in a Nutshell.
- Cay S. Hortmann and Gary Cornell: Core Java 2, Volume II – Advanced Features.

Additional references will be given occasionally during the semester.

Blackboard Site for this Unit of Study

Important information concerning this unit of study is placed on the Swinburne course management system (Blackboard), accessible via http://ilearn.swin.edu.au/

It is your responsibility to access on a regular basis
- the Blackboard site for your unit of study,
- the Announcements section on Blackboard, and
- any emails sent by the teaching staff to your student email address via Blackboard.

Swinburne student email is now provided by Live@edu to give students an improved email and calendaring service.

To login navigate to http://outlook.com and use the following login details:
- Login: <studentID>@student.swin.edu.au
- Default Password: Date of birth (DDMMYY)
- Email Address: <studentID>@student.swin.edu.au
- If you access your email through a provider other than Swinburne, it is your responsibility to ensure that your Swinburne email is redirected to your private email address.
Assessment
There will be regularly scheduled problem sets and programming assignments to help you learn the material and to allow us to evaluate your progress.

Assessment Task Details:
Problem sets will be handed out roughly every week or two. Most assignments will require laboratory work. You should expect to work on a problem set between two and four hours. If you have trouble finding a solution, ask for help! All assignments are fair and reasonable. No problem set will require more than six hours. Handouts for all problem sets will be made available online.

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Individual/ Group Task</th>
<th>Related Learning Objective(s)</th>
<th>Weighting</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8</td>
<td>Individual</td>
<td>1-6</td>
<td>25%</td>
<td>As specified on the assignment handouts</td>
</tr>
<tr>
<td>Midterm Test (2h)</td>
<td>Individual</td>
<td>1-5</td>
<td>25%</td>
<td>Week 6 or 7</td>
</tr>
<tr>
<td>Final Examination (2h)</td>
<td>Individual</td>
<td>1-5</td>
<td>50%</td>
<td>Exam period</td>
</tr>
</tbody>
</table>

Minimum Requirements to pass this Unit of Study:
There will be one mid-term test and a final exam. The final grade for the course will be weighted towards exams.
In order to achieve a pass in this unit of study, you must achieve a total overall mark of:
• 50% or more for the assignments and mid-term test
• 50% or more for the final exam.
Failure to submit assignment work may lead to disqualification from special examinations.
If a student achieves less than 45% on the final exam, he/she will be given a maximum mark of 44.
If a student achieves 45% to 49% on the exam and 50 or more in total, he/she will be given the exam percentage.

Assessment Criteria:
The final grade is calculated as follows:

<table>
<thead>
<tr>
<th>Final grade:</th>
<th>25% homework grade</th>
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<tbody>
<tr>
<td></td>
<td>25% mid-term test grade</td>
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<tr>
<td></td>
<td>50% final exam grade</td>
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</table>

Your grade is independent of anyone else's grade in this class. That is, we do not grade on a curve, and everyone can get an HD. Our purpose in grading is to uphold a standard of quality and to give you feedback: it is not to rank students.

All problem sets are equally weighted. In general every problem set is worth a different number of points. The maximum number of points equals 100%. You receive one grade for all problem sets, which calculated as follows:

Homework grade = sum of all homework’s / number of homework’s

Example:
• Problem set 1: 50 out of 75 = 67%
• Problem set 2: 67 out of 80 = 84%
• Problem set 3: 89 out of 90 = 99%

Grade: 67% + 84% + 99% / 3 = 83%
Occasionally, you may earn some extra marks for a problem set, if this problem set is particular challenging. Therefore, the final homework grade may be greater that 100%. Extra marks can help you to improve your final grade.

**Submission of Assignments:**

Homework problems are due on paper at the date and time specified on the handouts. In general, problem sets are due just before the lecture starts. If you have problems with a particular assignment, talk to the instructor before the deadline.

**Extensions and Late Submissions:**

Extensions will only be granted in exceptional circumstances on medical or compassionate grounds. Extensions must be applied for in advance of the assignment’s due date (Doctors certificate must be provided).

Absolutely no marks for late homework will be given at any time, unless otherwise negotiated in advance with the subject convener!

**Late assignment submissions will not be marked.**

**Assessment Results:**

Students must retain all assessed material that contributes to the final result up until such time as the final results are published.

**Plagiarism:**

Swinburne University of Technology defines Plagiarism as the action or practice of taking and submitting or presenting the thoughts, writings or other work of someone else as though it is your own work. Plagiarism includes any of the following, without full and appropriate acknowledgment to the original source(s):

- (i) The use of the whole or part of a computer program written by another person;
- (ii) the use, in essays or other assessable work, of the whole or part of a written work from any source including but not limited to a book, journal, newspaper article, set of lecture notes, current or past student’s work, any other person’s work, a website or database;
- (iii) the paraphrasing of another’s work;
- (iv) the use of musical composition, audio, visual, graphic and photographic models,
- (v) The use of realia, that is objects, artefacts, costumes, models and the like.

Plagiarism also includes the preparation or production and submission or presentation of assignments or other work in conjunction with another person or other people when that work should be your own independent work. This remains plagiarism whether or not it is with the knowledge or consent of the other person or people. It should be noted that Swinburne encourages its students to talk to staff, fellow students and other people who may be able to contribute to a student’s academic work but that where independent assignment is required, submitted or presented work must be the student’s own.

Enabling plagiarism contributes to plagiarism and therefore will be treated as a form of plagiarism by the University. Enabling plagiarism means allowing or otherwise assisting another student to copy or otherwise plagiarise work by, for example, allowing access to a draft or completed assignment or other work.

**Assessment and Appeals Policy and Procedure**

The information outlined in the Assessment sections above is covered in more detail in Swinburne’s Assessment and Appeals Policy and Procedure. Students must be familiar with the Policy and Procedure, found at http://policies.swinburne.edu.au/ppdonline/.

The Policy and Procedure provides details about:

- Assessment issues such as the conduct of examinations, plagiarism policies and details explaining how to apply for a review of results and other appeals, and
• Student progress issues such as unsatisfactory academic progress and early intervention procedures, and
• Information for students with disabilities and special needs and procedures for applying for special consideration.

Students should make themselves familiar with all aspects of the Policy and Procedure, as failure to do so is not grounds for appeal.

Students are advised to seek advice from the staff at the Swinburne Student Amenities Association SSAA (http://www.swinburne.edu.au/ssaa/) if they require assistance with advocacy for Sections 12 (At-Risk and Progress Review) and 13 (Appeals) of the Policy and Procedure.

Student Feedback

Swinburne seeks student feedback in a number of ways, including through periodic “Student Feedback on Units” and “Student Feedback on Teaching” surveys, as part of the university’s approach to quality assurance and improvement. Possible improvement based on both student and staff feedback is considered by Unit Convenors, Unit Panels made up of relevant teaching staff, Program Panels, Faculty Academic Committees, and the Academic Programs Quality Committee, as appropriate.

Safety Standards and Conduct Requirements

The University executes safety drills without warning. Be prepared to follow instructions from staff and/or wardens to evacuate the building in a safe and orderly manner.

All students are expected to respect the rights and sensibilities of their fellow students and teaching staff. This also applies in respect of the content of video and audio work submitted for assessment. The University has rigorous anti-discrimination and harassment policies and procedures. Students should refer to Swinburne Anti Discrimination Policy & Procedure, at http://policies.swinburne.edu.au/ppdonline/.

Safety procedures in laboratories must be followed. Open-toed shoes are not permitted in certain laboratories. Drink or food is not permitted in teaching spaces. The supervisor is authorised to exclude students for dangerous or disruptive behaviour which would result in forfeiture of all marks for the laboratory activity. The playing of computer games is not allowed in the computer labs.

Special Needs

If you have special needs you should advise your Faculty and the Unit of Study Convenor by the end of the second week of the teaching period. In addition, you are recommended to notify the Equity Office if you have not already done so.

See also the “Students with Disabilities and Special Needs” Section of the Assessment and Appeals Policy & Procedure, at: http://policies.swinburne.edu.au/ppdonline/.