Sarawak Campus
Faculty of Engineering, Computing and Science
Higher Education Division

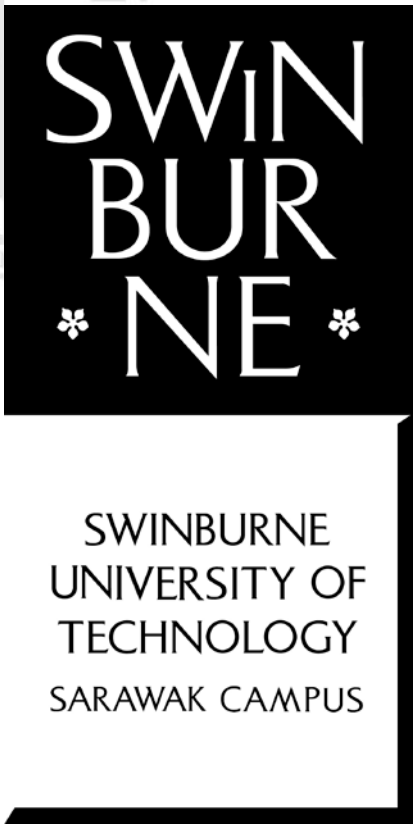
Unit of Study Outline

COS30008

Data Structures and Patterns

(Semester 1, 2019)

Version date (21 February, 2019)



Unit of Study Outline

Unit of study code	COS30008
Unit of study name	Data Structures and Patterns
Teaching Term/Semester & Year	Semester 1, 2019
Contact Hours (hrs/wk) or total contact hours	4 hours / week
Pre-requisites	COS20007 Object-Oriented Programming OR COS30016 Programming in Java OR COS20011 Software Development in Java OR SWE20004 Technical Software Development
Co-requisites	-
Credit Points	12.5

Aims

COS30008 – 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 Outcomes

Students who successfully complete this unit should be able to:

1. Apply 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 structures 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
6. Analyse algorithm designs and perform best-, average-, and worst-case analysis

Content

- Introduction
    - Basic concepts
    - Sets, arrays, indexer, and iterators
    - Asymptotic algorithm analysis
- Fundamental Data Structures
    - Dynamic arrays
    - Single-linked lists

- Data Types and Abstraction
  - Abstract data types
  - Design patterns
  - Pointers
  - Memory management
- Basic Container Types
  - Stacks
  - Queues
  - Ordered lists
  - Hash tables
- Hierarchical Data Types
  - Trees
  - Graphs
  - Tree traversals
- Algorithmic Patterns and Problem Solvers
  - Basics
  - Performance analysis
  - Greedy algorithms
  - Backtracking
  - Divide-and-Conquer

Key Generic Skills for this Unit of Study

You will be provided with feedback during the assessment for this unit of study on your progress in attaining the following generic skills that contribute to the development of these graduate attributes:

- Problem solving skills
- Technical competence
- Written communication skills

Learning and Teaching Structure

2 hours of lectures and 2 hours of lab per week

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.

Provisional Schedule

Week	Lecture Topic	Lab Topic	Assessment
1	Unit Overview A brief introduction to C++	Using Visual C++	
2	C++ Class and Inheritance	Basic I/O	Problem Set 1
3	Data Structure and Basic Concepts	Solution Design in C++	
4	Sets, arrays, indexer, and iterators	File I/O	Problem Set 2
5	Sets, arrays, indexer, and iterators (continue...)	Iterators	
6	Dynamic arrays, Single-linked lists	Design Pattern	Problem Set 3
Mid Semester Break			
7	Data Types and Abstraction	Mid-semester Test	Mid-semester Test
8	Basic Container Types	Doubly Linked-list	Problem Set 4

9	Tree	Memory Management	
10	Hierarchical Data Types	Btrees	Problem Set 5
11	Algorithmic Patterns and Problem Solvers	Testing and Debugging	
12	Revision	Revision	

Teaching Staff

Name	Role	Campus & Room No.	Phone No.	Email Address	Consultation Times
Mark Tee	Unit of Study Convenor / Lecturer / Tutor	SUTS & E612	082-260951 EXT 8951	mtktsun@swinburne.edu.my	via email with prior appointment
Fu Swee Tee	Moderator	SUTS & E612	082-260714 EXT 7714	sfu@swinburne.edu.my	-
Loke Kar Seng	Panel Member	SUTS & E207	082-260937 EXT 7937	ksloke@swinburne.edu.my	-

Blackboard Site for this Unit of Study

Important information concerning this unit of study is placed on a website on the Swinburne course management system (Blackboard), accessible via http://blackboard.swinburne.edu.my

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 email address via Blackboard.
- It is your responsibility to ensure that your email address on Blackboard is set to your preferred email address. To set your email address on Blackboard, go to My Institution, click on TOOLS > PERSONAL INFORMATION > EDIT PERSONAL INFORMATION.

A number of discussion boards are available for students to discuss assessment and general unit material. Students are encouraged to post questions related to the unit or the assessment on these forums.

Assessment

a. Assessment Task Details:

Tasks and Details	Individual / Group Task	Weighting	Related Learning Outcome(s)	Due Date (Tentative)
Problem Set 1 to 5	Individual	25%	1-6	As stated on the problem set handout.
Mid-semester Test	Individual	25%	1-5	Week 7
Final Exam	Individual	50%	1-5	Exam Period

b. Participation requirements

You are expected to attend all lecture and lab sessions scheduled for this unit. Regular lab completion is essential for success in this unit. The problem sets will be released progressively. You may consult your lab instructor on the problems faced during the weekly laboratory session. Feedback will be provided for each problem set.

c. Minimum requirements to pass this unit of study:

As the minimum requirements of assessment to pass a unit and meet all Unit Learning Outcomes to a minimum standard, a student must achieve:

i. an aggregate mark of 50% or more, and
ii. obtain at least 40% in the final exam

Students who do not successfully achieve hurdle requirement (ii) will receive a maximum of 44% as the total mark for the unit and will not be eligible for a conceded pass.

d. Assessment criteria:

Problem Set 1-5:

5% will be allocated for each problem set. Problem sets will be handed out roughly every two weeks. Most problem sets 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 problem sets are fair and reasonable. No problem set will require more than six hours. Handouts for all problem sets will be made available on blackboard.

Mid-semester Test:

25% will be allocated to correct answers for questions in the lab test.

Examination:

50% will be allocated to the final exam. The final examination is closed book.

e. Submission of Assignments

Problem sets are due on paper at the time and date specified in the handouts. In general, problem sets are due just before the lab starts, that is, you need to submit your problem set solution in lab. If you have problems with a particular assignment, talk to the instructor before the deadline.

Every problem set will have its own cover sheet to be used when submitting your solution.

Please provide your name and student id where indicated on the cover sheet.

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

f. 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.
- Assignments or projects which are submitted after the due date and time will attract a penalty of 10% of the total marks available per working day late, up to a maximum of five working days. Assignments submitted after five working days past the published deadline will be graded with zero marks.

- Feedback or comments from the marker will generally not be available on assignments which are submitted after five working days past the published deadline.

g. Availability of Assessment Results, Retention of Assessed Materials:

Assessed material will be returned to you, but you must retain all assessed material that contributes to the final grade up until such time as the final grades are published. The assessed material must, after a reasonable time, be produced on demand for review by the Convenor. Non-compliance with this requirement may result in loss of all credit for the assessed material not so produced.

h. Groupwork Guidelines:

This unit does not include group assignments.

i. Swinburne University of Technology's definition of plagiarism:

Plagiarism is 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.

The information outlined in this section above is covered in more detail in Swinburne Sarawak's Student Academic Misconduct Regulations 2012 found at http://www.swinburne.edu.au/policies/regulations/academicmisconduct.html

Students must be familiar with the regulations found at Student Administration > Assessment > Misconduct and Plagiarism at http://www.swinburne.edu.au/student-administration/assessment/misconduct.html

j. Assessment and Appeals Policy and Procedure

The information outlined in the Assessment sections above is covered in more detail in Swinburne Sarawak's Assessment and Results Policy. Students must be familiar with the Policy found at http://www.swinburne.edu.au/policies/academic/assessment.html and http://www.swinburne.edu.au/policies/regulations/reviews.html

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.

Student Charter

The charter describes what students can reasonably expect from Swinburne in order to enjoy a quality learning experience. As students contribute to their own learning experience and to that of their fellow students, the charter also defines the University's expectations of students. Please familiarise yourself with Swinburne's Student Charter found at http://www.swinburne.edu.au/policies/hr/students.html

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 had implemented anti-discrimination and harassment policies and procedures to promote a discrimination and harassment free work and study environment for all staff and students: http://www.swinburne.edu.au/policies/hr/behaviour.html

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 Counselling Unit under Students Administration if you have not already done so.

See also the Swinburne "Adjustments to assessment arrangements and Special Consideration" Section of the Assessment and Results Policy, at http://www.swinburne.edu.au/policies/academic/assessment.html#special

Resources and Reference Material

The following learning resources have been provided to assist your learning in this unit of study:

- Lecture notes and lab exercises can be downloaded from the Blackboard web site. These are details on the material you will need to read each week, as well as lab exercises for you to undertake.
- Reference Books / Articles:
    - Bruno R. Preiss: Data Structures and Algorithms with Object-Oriented Design Patterns in C++/Java/C#/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.

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein: Introduction to Algorithms. 2nd Edition.
- Kenneth A. Berman and Jerome L. Paul: Algorithms: Sequential, Parallel, and Distributed.
- Michael T. Goodrich and Roberto Tamassia: Algorithm Design: Foundations, Analysis, and Internet Examples.
- Russ Miller and Laurence Boxer: Algorithms Sequential and Parallel - A Unified Approach. 2nd Edition.
- Kenneth H. Rosen: Discrete Mathematics and Its Applications.
- Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo: C++ Primer. 4th Edition.
- Nicolai M. Josuttis: The C++ Standard Library - A Tutorial and Reference.
- Harold Abelson et al.: Structure and Interpretation of Computer Programs.
- Gary J. Bronson: Program Development and Design Using C++, 3rd Edition.