

## SENG1120: Data Structures

Callaghan

Semester 1 - 2024



THE UNIVERSITY OF  
NEWCASTLE  
AUSTRALIA

## OVERVIEW

**Course Description** This course expands the problem-solving techniques of SENG1110 to large problems, with a study of an object-oriented software analysis and design methodology. Software implementation techniques and standards are introduced with the aim of improving programming skills. Students use fundamental algorithmic techniques and structures such as stacks, queues, trees and heaps as tools for problem solving design and implementation.

**Academic Progress Requirements** Nil

**Assumed Knowledge** SENG1110 or INFT2012  
**Contact Hours** Callaghan  
**Computer Lab \***  
Face to Face On Campus  
2 hour(s) per week(s) for 13 week(s) starting Week 1  
**Lecture**  
Face to Face On Campus  
2 hour(s) per week(s) for 13 week(s) starting Week 1

**Unit Weighting** \* This contact type has a compulsory requirement.  
**Workload** 10  
Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

# COURSE OUTLINE

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# CONTACTS

**Course Coordinator**     **Callaghan**  
Dr Kyle Harrison  
Kyle.Harrison@newcastle.edu.au  
(02) 4055 0738  
Consultation: Fridays, 2-3pm in ES214 or by appointment.

**Teaching Staff**             Other teaching staff will be advised on the course Canvas site.

**School Office**             **School of Information and Physical Sciences**  
SR233, Social Sciences Building  
Callaghan  
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9am-5pm (Mon-Fri)

# SYLLABUS

**Course Content**

1.             Object oriented programming techniques
2.             Stacks, queues, trees, heaps, hash tables
3.             Methods for searching and sorting
4.             Recursion
5.             Hashing

**Course Learning Outcomes**     **On successful completion of this course, students will be able to:**

1. Understand the Object-Oriented notions and how the notions are implemented in object-oriented programming languages.
2. Understand the need for the most appropriate data structure to provide the best solution to a problem.
3. Understand and use Linear, Hierarchical and Graph Structures in problem solving and algorithms.
4. Understand and use arrays and linked structures in implementing data structures.

**Course Materials**             **Recommended Text:**

- "Data Structures and Algorithm Analysis in C++", 4th Edition, M.A. Weiss, Pearson, 2014.

# COMPULSORY REQUIREMENTS

In order to pass this course, each student must complete ALL of the following compulsory requirements:

## Contact Hour Requirements:

- Computer Lab Attend 80% of sessions

## Course Assessment Requirements:

- Assessment 5 - Formal Examination: Pass requirement 40% - Must obtain 40% in this assessment item to pass the course.

## Compulsory Placement and WHS Requirements:

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# SCHEDULE

# ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Class Exam	Week 5 (11:59PM on Monday 25 March)	Individual	10%	1, 2
2	Assignment 1	Week 6 (11:59PM on Sunday 7 April)	Individual	15%	1, 2, 3, 4
3	Assignment 2	Week 10 (11:59PM on Sunday 19 May)	Individual	10%	1, 2, 3, 4
4	Assignment 3	Week 13 (11:59PM on Sunday 9 June)	Individual	15%	1, 2, 3, 4
5	Formal Examination*	Examination Period. Date to be determined by the Examinations Team.	Individual	50%	1, 2, 3, 4

\* This assessment has a compulsory requirement.

## Late Submissions

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

## Assessment 1 - Class Exam

<b>Assessment Type</b>	In Term Test
<b>Purpose</b>	To measure the learning outcomes of the first 4 weeks of lectures.
<b>Description</b>	Test specifications will be posted on Canvas.
<b>Weighting</b>	10%
<b>Length</b>	60 minutes
<b>Due Date</b>	Week 5 (11:59PM on Monday 25 March)
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	
<b>Return Method</b>	Not Returned
<b>Feedback Provided</b>	Online - .
<b>Opportunity to Reattempt</b>	Students WILL NOT be given the opportunity to reattempt this assessment.

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## Assessment 2 - Assignment 1

<b>Assessment Type</b>	Written Assignment
<b>Purpose</b>	To measure the student's ability to implement and/or use a linked list structure to solve an underlying problem in C++.
<b>Description</b>	Assignment specifications will be posted on Canvas.
<b>Weighting</b>	15%
<b>Due Date</b>	Week 6 (11:59PM on Sunday 7 April)
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	To be posted on Canvas together with the Assessment Specs.
<b>Return Method</b>	Online
<b>Feedback Provided</b>	Online - .
<b>Opportunity to Reattempt</b>	Students WILL NOT be given the opportunity to reattempt this assessment.

## Assessment 3 - Assignment 2

<b>Assessment Type</b>	Written Assignment
<b>Purpose</b>	To measure the student's ability to implement and/or use one or more specialized containers (e.g., stacks and queues) to solve an underlying problem in C++.
<b>Description</b>	Assignment specifications will be posted on Canvas.
<b>Weighting</b>	10%
<b>Due Date</b>	Week 10 (11:59PM on Sunday 19 May)
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	To be posted on Canvas together with the Assessment Specs.
<b>Return Method</b>	Online
<b>Feedback Provided</b>	Online - .
<b>Opportunity to Reattempt</b>	Students WILL NOT be given the opportunity to reattempt this assessment.

## Assessment 4 - Assignment 3

<b>Assessment Type</b>	Written Assignment
<b>Purpose</b>	To measure the student's ability to implement and/or use complex data structures (e.g., hash tables and binary search trees) to solve an underlying problem in C++.
<b>Description</b>	Assignment specifications will be posted on Canvas.
<b>Weighting</b>	15%
<b>Due Date</b>	Week 13 (11:59PM on Sunday 9 June)
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	To be posted on Canvas together with the Assessment Specs.
<b>Return Method</b>	Online
<b>Feedback Provided</b>	Online - .
<b>Opportunity to Reattempt</b>	Students WILL NOT be given the opportunity to reattempt this assessment.

## Assessment 5 - Formal Examination

<b>Assessment Type</b>	Formal Examination
<b>Purpose</b>	The final formal examination is designed to test the individual student's knowledge of the course material and their ability to apply that knowledge.
<b>Description</b>	Students whose overall mark in the course is 50% or more, but who score less than 40% in the compulsory item and thus fail to demonstrate the required proficiency, will be awarded a Criterion Fail grade, which will show as FF on their formal transcript. However, students in this position who have scored at least 25% in the compulsory item will be allowed to undertake a supplementary 'capped' assessment in which they can score at most 50% of the possible mark for that item.
<b>Weighting</b>	50%
<b>Compulsory Requirements</b>	Pass requirement 40% - Must obtain 40% in this assessment item to pass the course..
<b>Due Date</b>	Examination Period. Date to be determined by the Examinations Team.
<b>Submission Method</b>	Formal Exam
<b>Assessment Criteria</b>	Correctness and clarity of written answers and/or program code.
<b>Return Method</b>	Not Returned

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**Feedback Provided** No Feedback - .  
**Opportunity to Reattempt** Students WILL be given the opportunity to reattempt this assessment.

## ADDITIONAL INFORMATION

### Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

\*Skills are those identified for the purposes of assessment task(s).

### Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

### Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

### Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the [Oral Examination \(viva\) Procedure](#). In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the [Student Conduct Rule](#).

### Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to <https://policies.newcastle.edu.au/document/view-current.php?id=35>.

### Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the

online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:

<https://policies.newcastle.edu.au/document/view-current.php?id=236>

### Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at <https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures> that support a safe and respectful environment at the University.

## GRADUATE PROFILE STATEMENTS

The following table illustrates how this course contributes towards building the skills students will need to work in their profession.

### Level of capability

- Level 1 indicates an introduction to a topic at a university level
- Levels 2 and 3 indicate progressive reinforcement of that topic
- Level 4 indicates skills commensurate with a graduate – entry to professional practice
- Level 5 indicates highly specialist or professional ability

### Bachelor of Information Technology

	University of Newcastle Bachelor of Information Technology Graduate Profile Statement	Taught	Practised	Assessed	Level of capability
1	Demonstrate a comprehensive understanding of the discipline of information technologies with an emphasis on net-centric applications, information management, and user requirements for ethical professional practice.	X	X	X	1
2	Apply critical reasoning and systems thinking to understand and support the operation and constraints of contemporary enterprises and their dynamic environment.				
3	Work independently and collaboratively to locate, manage and organise information and resources and apply evidence-based methodologies to create, modify and maintain designs and design solutions.				
4	Use creativity, problem solving skills, project management skills and technical expertise to analyse, interpret, evaluate and generate solutions to complex technical and organisational problems.	X	X	X	1
5	Demonstrate professional judgement and responsibility by communicating information technology principles, practices, standards to specialist and non-specialist audience clearly and persuasively.				

**Bachelor of Engineering**

	<b>University of Newcastle Bachelor of Engineering Graduate Profile Statements</b>	<b>Taught</b>	<b>Practised</b>	<b>Assessed</b>	<b>Level of capability</b>
	<b>Knowledge Base</b>				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	X	X	X	2
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	X	X	X	2
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	X	X	X	1
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.	X	X	X	1
5	1.5. Knowledge of contextual factors impacting the engineering discipline.				
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				
	<b>Engineering Ability</b>				
7	2.1. Application of established engineering methods to complex engineering problem solving.	X	X	X	1
8	2.2. Fluent application of engineering techniques, tools and resources.	X	X	X	1
9	2.3. Application of systematic engineering synthesis and design processes.	X	X	X	1
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	<b>Professional Attributes</b>				
11	3.1. Ethical conduct and professional accountability				
12	3.2. Effective oral and written communication in professional and lay domains.	X	X	X	1
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.				
15	3.5. Orderly management of self, and professional conduct.				
16	3.6. Effective team membership and team leadership.				

**Bachelor of Computer Science**

	<b>University of Newcastle Bachelor of Computer Science Graduate Profile Statement</b>	<b>Taught</b>	<b>Practised</b>	<b>Assessed</b>	<b>Level of capability</b>
1	Knowledge of basic science and computer science fundamentals	X	X	X	2
2	In depth technical competence in the discipline of computer science	X	X	X	1
3	An ability to carry out problem analysis, requirements capture, problem formulation and integrated software development for the solution of a problem	X	X	X	2
4	Capacity to continue developing relevant knowledge, skills and expertise in computer science throughout their careers	X	X		1
5	An ability to communicate effectively with other Computer Scientists, Software Engineers, other professional disciplines, managers and the community generally	X	X	X	1
6	Ability to undertake and co-ordinate large computer science projects and to identify problems, their formulation and solution				
7	Ability to function effectively as an individual, a team member in multidisciplinary and multicultural teams and as leader/manager with capacity to assist and encourage those under their direction				
8	Understanding of social, cultural, global and business opportunities of the professional computer scientist; understanding the need for and principles of sustainability and adaptability				
9	Understanding of professional and ethical responsibilities and a commitment to them				
10	Understanding of entrepreneurship; need of and process of innovation, as well as the need of and capacity for lifelong learning				

*This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.*

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