

# Unit Outline (Higher Education)

**Institute / School:** Institute of Innovation, Science & Sustainability

**Unit Title:** DATA STRUCTURES AND ALGORITHMS

**Unit ID:** ITECH3109

**Credit Points:** 15.00

**Prerequisite(s):** (ITECH2100 or ITECH2306 or ITECH5007)

**Co-requisite(s):** Nil

**Exclusion(s):** (ITECH3218)

**ASCED:** 020109

## Description of the Unit:

This unit will explore program design approaches ensuring efficient computing to solve complex problems. In particular, students will study methods for analysing algorithms' time and space efficiency using asymptotic notation. Students will apply this analysis as they study a range of data structures and the algorithms used for processing such structures. Algorithms covered will include standard sorting and searching methods through to tree, graph and flow network processing algorithms. Finally, this unit will discuss implementation of each approach from scratch, as well as through the use of a built-in Application Programming Interface (API). Upon completion of this unit students will be able to determine and implement the appropriate data structure and algorithm to solve a range of problems, as well as be able to determine the efficiency of the solution.

**Grade Scheme:** Graded (HD, D, C, P, MF, F, XF)

## Work Experience:

No work experience: Student is not undertaking work experience in industry.

**Placement Component:** No

**Supplementary Assessment:** Yes

Where supplementary assessment is available a student must have failed overall in the Unit but gained a final mark of 45 per cent or above, has completed all major assessment tasks (including all sub-components where a task has multiple parts) as specified in the Unit Description and is not eligible for any other form of supplementary assessment

**Course Level:**

Level of Unit in Course	AQF Level of Course					
	5	6	7	8	9	10
Introductory	■	■	■	■	■	■
Intermediate	■	■	■	■	■	■
Advanced	■	■	✓	■	■	■

### Learning Outcomes:

#### Knowledge:

- K1.** Describe ways in which to measure the efficiency of an algorithm.
- K2.** Identify the computational complexity of a range of complex problems.
- K3.** Discuss the purpose and need for abstract data types in the definition of data structures.
- K4.** Define a range of common data structures along with their appropriate application.
- K5.** Explain how a range of sorting, searching, tree, graph and network flow algorithms work to solve complex problems.
- K6.** Identify appropriate API classes and calls to solve complex problems.

#### Skills:

- S1.** Calculate and compare the efficiency of algorithms.
- S2.** Specify abstract data types to describe the design of various data structures.
- S3.** Implement common data structures and algorithms from first principles.
- S4.** Solve complex problems using API provided algorithms and data structures.
- S5.** Validate algorithms' performance empirically and compare with their theoretical efficiency.

#### Application of knowledge and skills:

- A1.** Design, develop, debug and test program solutions for given textual, informally written program specifications.

#### Unit Content:

Topics may include:

- Efficiency of algorithms, time and space complexity.
- Computational complexity of problems.
- Range of data structures.
- Sorting and searching algorithms.
- Tree processing algorithms.
- Graph theory.

- Graph processing algorithms.
- Network-flow algorithms.
- Implementation issues such as memory management, data types, generics.
- API based implementations of algorithms.
- Empirical testing and validation of algorithm implementations.

## FEDTASKS

Federation University Federation recognises that students require key transferable employability skills to prepare them for their future workplace and society. FEDTASKS (**T**ransferable **A**tttributes **S**kills and **K**nowledge) provide a targeted focus on five key transferable Attributes, Skills, and Knowledge that are embedded within curriculum, developed gradually towards successful measures and interlinked with cross-discipline and Co-operative Learning opportunities. *One or more FEDTASK, transferable Attributes, Skills or Knowledge must be evident in the specified learning outcomes and assessment for each FedUni Unit, and all must be directly assessed in each Course.*

FEDTASK attribute and descriptor		Development and acquisition of FEDTASKS in the Unit	
		Learning Outcomes (KSA)	Assessment task (AT#)
FEDTASK 1 Interpersonal	Students will demonstrate the ability to effectively communicate, inter-act and work with others both individually and in groups. Students will be required to display skills in-person and/or online in: <ul style="list-style-type: none"> <li>• Using effective verbal and non-verbal communication</li> <li>• Listening for meaning and influencing via active listening</li> <li>• Showing empathy for others</li> <li>• Negotiating and demonstrating conflict resolution skills</li> <li>• Working respectfully in cross-cultural and diverse teams.</li> </ul>	Not applicable	Not applicable

FEDTASK attribute and descriptor		Development and acquisition of FEDTASKS in the Unit	
		Learning Outcomes (KSA)	Assessment task (AT#)
FEDTASK 2 Leadership	<p>Students will demonstrate the ability to apply professional skills and behaviours in leading others. Students will be required to display skills in:</p> <ul style="list-style-type: none"> <li>• Creating a collegial environment</li> <li>• Showing self-awareness and the ability to self-reflect</li> <li>• Inspiring and convincing others</li> <li>• Making informed decisions</li> <li>• Displaying initiative</li> </ul>	Not applicable	Not applicable
FEDTASK 3 Critical Thinking and Creativity	<p>Students will demonstrate an ability to work in complexity and ambiguity using the imagination to create new ideas. Students will be required to display skills in:</p> <ul style="list-style-type: none"> <li>• Reflecting critically</li> <li>• Evaluating ideas, concepts and information</li> <li>• Considering alternative perspectives to refine ideas</li> <li>• Challenging conventional thinking to clarify concepts</li> <li>• Forming creative solutions in problem solving.</li> </ul>	K1-K5, S1-S5, A1	AT1, AT2 and A3
FEDTASK 4 Digital Literacy	<p>Students will demonstrate the ability to work fluently across a range of tools, platforms and applications to achieve a range of tasks. Students will be required to display skills in:</p> <ul style="list-style-type: none"> <li>• Finding, evaluating, managing, curating, organising and sharing digital information</li> <li>• Collating, managing, accessing and using digital data securely</li> <li>• Receiving and responding to messages in a range of digital media</li> <li>• Contributing actively to digital teams and working groups</li> <li>• Participating in and benefiting from digital learning opportunities.</li> </ul>	Not applicable	Not applicable

FEDTASK attribute and descriptor		Development and acquisition of FEDTASKS in the Unit	
		Learning Outcomes (KSA)	Assessment task (AT#)
FEDTASK 5 Sustainable and Ethical Mindset	Students will demonstrate the ability to consider and assess the consequences and impact of ideas and actions in enacting ethical and sustainable decisions. Students will be required to display skills in: <ul style="list-style-type: none"> <li>• Making informed judgments that consider the impact of devising solutions in global economic environmental and societal contexts</li> <li>• Committing to social responsibility as a professional and a citizen</li> <li>• Evaluating ethical, socially responsible and/or sustainable challenges and generating and articulating responses</li> <li>• Embracing lifelong, life-wide and life-deep learning to be open to diverse others</li> <li>• Implementing required actions to foster sustainability in their professional and personal life.</li> </ul>	Not applicable	Not applicable

### Learning Task and Assessment:

Learning Outcomes Assessed	Assessment Tasks	Assessment Type	Weighting
K1, K2, S1, S3	Demonstrate the ability to analyze and solve programming problems by implementing recursive/iterative algorithms.	Lab Test(s)	10 - 20%
K4 - K6, S1 - S5, A1	Solve complex programming problems by modifying and implementing provided algorithms and data structures.	Assignments and/or projects.	50 - 60%
K1 - K6, S1 - S4	Class attendance and exercises, reading of reference material and lecture notes.	Final Examination/Test	25 - 30%

### Adopted Reference Style:

APA

Refer to the [library website](#) for more information

Fed Cite - [referencing tool](#)