SC1007: DATA STRUCTURES AND ALGORITHMS

Course Introduction

College of Computing and Data Science

Instructor Information

- Dr Newton FERNANDO (ofernando@ntu.edu.sg)
  - Course coordinator
  - Research background: Human-computer interaction, multimodal and natural interfaces, crowdsourcing
  - Room No: N4-2C-80

- Asst. Prof. Luu Anh Tuan (anhtuan.luu@ntu.edu.sg)
  - Research background: Artificial Intelligence, Deep Learning, and Natural Language Processing
  - Room No: : N4-02c-86

- Owen Noel **Newton Fernando**

- Email: ofernando@ntu.edu.sg

- Office: NTU, N4-02c-80

- Office hours:
  - **Wednesday 16.00 PM-18.00 PM** (no appointment needed)
  - Other times by appointment (Email)

Course Schedule (Lectures, Labs, tutorials and assignments)

Week	Topic	Tutorials	Labs	Assignment Deadlines
1	Introduction and Memory Management in Python	No Tutorial	No Labs	
2	Linked List (LL)	No Tutorial	No Labs	
3	Linked Lists : Doubly linked Lists and Circular lists.	No Tutorial	Lab 1 (LL)	
4	Stacks and Queues	T1 (LL)	Lab 2 (SQ)	
5	Priority Queues and Arithmetic Expressions	T2 (SQ)	Lab 3 (BT)	
6	Tree Structures: Binary Trees, Binary Search Trees, and AVL Trees	T3 (BT & BST)	Lab 4 (BST)	AS1 (LL) and SQ **(19/09/2025)**
7	No Lecture	No Tutorial	No Labs **Lab Test 1**	AS2 (BT and BST) **(26/09/2025)**
		Recess Week		
8	Introduction to algorithms	No Tutorial	No Labs	
9	Analysis of Algorithms	No Tutorial	Lab 5 (Complexity)	
10	Heap Analysis	T4 (Complexity + Searching)	Lab 6 (Searching)	
11	Searching	T5 (Hash Table)	Lab 7 (Hash Table)	
12	Hash Table and String Search with Trie	T6 (Trie)	Lab 8 (Trie)	AS3: Complexity + Searching **(07/11/2025)**
13	No Lecture	No Tutorial	No Labs **Lab Test 2 + Quiz**	AS4: Hash Table + Trie **(14/11/2025)**

Assignments, Lab Tests, and Final Quiz

Assessments	Weighting
Assignments (4 Assignments)	40%
Lab Tests (Two Lab Tests):	40%
Quiz (1 Quiz)	20%

Content Copyright Nanyang Technological University

Roadmap (Lectures): First Half

Week	Lecture (Venue: LKC-LT) Tuesday: 2.30 PM – 4.30 PM
1	Introduction and Memory Management in Python
2	Linked List (LL)
3	Linked Lists : Doubly linked Lists and Circular lists.
4	Stacks and Queues
5	Priority Queues and Arithmetic Expressions
6	Tree Structures: Binary Trees, Binary Search Trees, and AVL Trees

Roadmap (Labs and Tutorials): First Half

Week	Tutorial	Lab
1	**No Tutorial**	**No Labs**
2	**No Tutorial**	**No Labs**
3	**No Tutorial**	Linked Lists
4	Linked Lists	Stack and Queues
5	Stack and Queues	Binary Trees
6	Binary Tree and Binary Search Trees	Binary Search Trees
7	**No Tutorial**	Lab Test 1

Roadmap (Assignments): First Half

NO	Assignment	Release date	Deadline (11.59 PM)
1	Linked Lists and Stack & Queues	05/09/2025	19/09/2025
2	Binary Tree and Binary Search Trees	12/09/2025	26/09/2025

www.hackerearth.com online platform will be used for the assignments' submission.

Roadmap (Lab Test): First Half (Week 07)

- Lab Test 1 sessions will be conducted in physical laboratories.

- Lab test information will be released two weeks before the deadline.

- The www.hackerearth.com online platform will be used for the lab test.

Lab Test	Venue	Date	Time
Lab Test 1	**To Be confirmed**	**26/09/2025**	**4.30 PM – 6.30 PM**
Lab Test 1 (Make-up Test)	**To Be confirmed**	**10/10/2025**	**4.30 PM – 6.30 PM**

Reading Reference

- Alan Broder, John Canning, and Robert Lafore, "Data Structures & Algorithms in Python", Pearson, 1st Edition, 2023

- Y Daniel Liang, " Introduction to Python Programming and Data Structures," 3rd edition, Pearson, 2023

- Lectures focus on introduction to concepts

- Tutorials focus on understanding the concepts

- Lab Sessions focus on practice and realization

- Assignments and Lab Tests are assessments

Learning Outcome

- Understand and use data structures such as linked lists, stacks, queues, trees and heaps effectively in Python.

- Choose suitable data structures in solving real-world problems, optimizing performance in computational challenges.

- Analyse the time and space complexity of algorithms to evaluate the efficiency of algorithmic solutions.

- Use suitable searching techniques, such as sequential search, binary search, search using hash tables and string search using Tries, to real-world applications requiring fast and efficient data retrieval.

Overview of SC1007

- **Data Structures**:
  - Concepts of data structures
  - Introduce some classical data structures
    - Linear: Linked list, stack, queue
    - Nonlinear: tree
  - Implement these data structures
- **Algorithms**:
  - Analysis of Algorithm time complexity and space complexity
  - Introduce to some typical algorithms and their applications
  - Introduce to some algorithm design strategies
- **Implementation**:
  - Python

Goals

"I will, in fact, claim that the difference between a bad programmer and a good one is whether he considers his code or his data structures more important. Bad programmers worry about the code. Good programmers worry about data structures and their relationships."

Linus Torvalds, 2006

(Creator of the Linux kernel)