Data Structures and Algorithms Southwest University, China: Outline of Lecture Topics and Schedule for October 2020

*This schedule will be updated as necessary during the teaching period*

### Week 1: Lists

Mon 12 Oct

intro, algorithms, data structures,  
abstract data types (ADTs),  
Java interfaces and generic types

Tues 13 Oct

stacks (array implementation), queues (array implementation),  
linked lists,  
queues (linked list implementation),  
linked list insertion and deletion

Wed 14 Oct

Big O notation

Thurs 15 Oct

Algorithm example: Insertion sort,  
sorting algorithms: merge, select,  
sequential search, step search, binary search.  
**Week 1 quiz**.

### Week 2: Trees

Mon 19 Oct

Recursion, linked list review

Tues 20 Oct

trees, tree representations,  
binary trees, tree traversals

Wed 21 Oct

binary search trees and operations,  
binary tree find min and remove min operations

Thu 22 Oct

priority queues: linked list impl,  
priority queues: binary heap impl

### Week 3: Graphs

Mon 26 Oct

Revision, graphs,  
graph data structures

Tues 27 Oct

Breadth first search,  
Minimum Spanning Tree algorithms - Kruskal, Prim

Wed 28 Oct

Implementation of Prim’s algorithm

Thu 29 Oct

Java collections API (deques, sets, maps, hash tables)

## Text Book

Mark Allen Weiss, *Data Structures & Problem Solving Using Java* (4th edition, Pearson Education).  
ISBN-13: 9780321541406  
ISBN-10: 0321541405

(other editions are also fine)

## UWA Lecture Notes

Notes from the Data Structures & Algorithms unit at the University of Western Australia.

## Recommended Reading for the SWU Data Structures Course

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| **Theme** | **Text book reference (Weiss)** | **UWA notes** |
| Intro | ch 5. algorithm analysis | Topic01-IntroDS.pdf  Topic02-IntroAlg.pdf  Topic06-Complexity.pdf  Topic07-BigO.pdf |
| Lists | ch 6.6 stacks and queues  ch 16 stacks and queues (implementation) | Topic03-Abstract.pdf  Topic04-Queues.pdf  Topic05-Lists.pdf |
| Lists | ch 8.1-8.3 sorting algorithms | Topic01-IntroDS.pdf  Topic07-BigO.pdf  Topic08-Amort.pdf |
| Lists | ch 7.1-7.5 recursion  ch 8.5-8.6 sorting algorithms |  |
| Trees | ch 17. Linked lists |  |
| Trees | ch 18.1 trees ch 18.4 tree traversals | Topic10-Trees-Graphs.pdf  Topic11-TreeReps.pdf |
| Trees | ch 19.1-19.3 binary search trees | Topic12-Traversals.pdf |
| Trees | ch 6.9 priority queues (specs) ch 21. priority queues (impl) ch 13.2 event-driven simulation | T opic13-PriorityQueues.pdf |
| Graphs | ch 6 the collections api | Topic16-Maps.pdf  Topic17-S etsTablesDictionaries.pdf  Topic19-Hash.pdf |
| Graphs | ch 14.1 graphs and paths | Topic10-Trees-Graphs.pdf  Topic11-TreeReps.pdf |
| Graphs | ch 14.5.1 topological sorting | Topic12-Traversals.pdf |
| Graphs | ch 24.2.2 minimum spanning trees | Topic14-MST.pdf |

## Summary of Lab Exercises

### Exercise 1

Java revision:

* Development environment
* primitive java types

### Exercise 2

Java revision:

* Correctness
* Reference types

### Exercise 3

Java revision:

* Array exercises
* Objects and classes

### Exercise 4

Linked lists.

* Write a linked list implementation of the Set interface from the Java Collections Framework, implementing add, remove, isEmpty, contains, size and toString.

### Exercise 5

Binary Search.

* Week 1 Problem Sheet Questions 4 and 5
* Measurement of sorting functions

### Exercise 6

Sorting:

* Week 1 Problem Sheet Question 28. Sorting measurement.

### Exercise 7

Binary trees.

* Week 2 Problem Sheet Questions 10 and 11.

### Exercise 9

Graphs.

* Use AdjacencyMatrixGraph.java and add some code for Week 3 Problem Sheet Questions 11, 12, 13, 15, 17.
* Reading: Weiss Chapter 14.

### Exercise 10

Revision Questions for the exam