

Effective: Fall 2022

## COURSE INFORMATION

**Course Title:** Data Structures and Algorithms

**Course Number:** CSCI 225

**Credits:** 3

**Total Weeks:** 14 (Fall, Spring)  
12 (Summer)

**Total Hours:** 39

**Course Level:** ☐ First Year ☒ Second Year  
☐ New ☐ Revised Course  
☐ Replacement Course

**Department:** Computer Science **Department Head:** M. O'Connor **Former Course Code(s) and Number(s) (if applicable):** N/A

**Pre-requisites (If there are no prerequisites, type NONE):** CSCI 125

**Co-requisite Statement (List if applicable or type NONE):** None

**Precluded Courses:** N/A

## COURSE DESCRIPTION

This course will examine data structures and how they assist us in solving complex problems. Topics include: abstract data types (abstraction, encapsulation, information hiding), data structures (arrays, lists, stacks, queues, trees, heaps, sets, and hash tables), searching and sorting algorithms, correctness and efficiency, and object-oriented programming. All implementations will use the Java programming language.

## LEARNING OUTCOMES

Upon successful completion of the course, students will be able to:

- Explain the fundamentals of data structures.
- Understand and apply the concept of abstract data types (ADTs).
- Use elementary data structures from the Java API such as arrays and lists, to solve problems.
- Demonstrate skills in tracing, analyzing, and designing recursive algorithms and recursive methods.
- Understand the purpose of algorithm analysis and be able to apply this to determine the running-time of simple non-recursive algorithms and recursive methods. Define and use big-O notation.
- Understand and implement various sorting algorithms and analyse the running-time required to determine their efficiencies.
- Describe, analyse and implement linear search and binary search algorithms.
- Describe how to use generic classes and methods in Java.
- Demonstrate how and when to use a linked list to store elements. Write code for basic operations such as add, insert, remove, and traverse
- Understand the doubly linked list data structure.
- Describe what a stack and what a queue is. Understand how to write array-based and linked list-based stack and queue classes to solve small but realistic problems.
- Describe in-depth applications of other data types such as trees (binary, binary search and AVL) and heap.
- Understand the characteristics and optimal behaviour of hash tables for access and retrieval.
- Explain the basics of graphs and their applications.

## INSTRUCTION AND GRADING

Instructional (Contact) Hours:

Type	Duration
Lecture	39
Seminars/Tutorials	
Laboratory	
Field Experience	
Other ( <i>specify</i> ):	
Total	39

**Grading System:** Letter Grades ☒ Percentage ☐ Pass/Fail ☐ Satisfactory/Unsatisfactory ☐ Other ☐

**Specify passing grade:** 50%

**Evaluation Activities and Weighting** (total must equal 100%)

Assignments: 20% <i>Specify number of, variety, and nature of assignments:</i>	Lab Work: %	Participation: 15% <i>Specify nature of participation:</i>	Project: % <i>Specify nature of project:</i>
Quizzes/Test: %	Midterm Exam: 25%	Final Exam: 40%	Other: %

## TEXT(S) AND RESOURCE MATERIALS

Provide a full reference for each text and/or resource material and include whether required/not required.

Tony Gaddis, Godfrey Muganda: Starting Out with Java: From Control Structures through Data Structures, 4th Edition. Pearson. 2019. ISBN 013478796X • 9780134787961.

## COURSE TOPICS

List topics and sequence covered.

Week 1	Introduction Data Structures, Abstract Data Types, Array and ArrayList class
Week 2	Introduction to Stacks, their Applications and Implementation; Generics
Week 3	Introduction to Queues, their Applications and Implementation
Week 4	Introduction to Algorithms, Algorithm Analysis and O Notation; Searching Algorithms
Week 5	Sorting Algorithms
Week 6	<b>Midterm</b> Advanced Sorting Algorithms
Week 7	Linked Lists and their Implementations

Week 8	Binary Trees
Week 9	AVL Trees
Week 10	Hashing
Week 11	Priority Queues, their Applications and Implementation
Week 12	Heapsort
Week 13	Introduction to Graphs
Week 14	<b>Final Exam</b>

**NOTES**

1. Students are required to follow all College policies. Policies are available on the website at: [Coquitlam College Policies](#)
2. To find out how this course transfers, visit the BC Transfer Guide at: [bctransferguide.ca](http://bctransferguide.ca)

**Last Revised:** September 2022

**Last Reviewed:** September 2024