

# 08-722 Data Structures for Application Programmers

## Spring 2018 Mini 4 (6 units) Tentative Syllabus

Doherty Hall 2315

Tuesdays and Thursdays 12pm – 1:20pm

All the course materials will be posted on Canvas

### Course Description

This course is an introduction to Data Structures and a few fundamental algorithms for students with some prior programming experience (basic understanding of Object-Oriented Programming, functions, loops, and arrays mainly in Java). It covers the conceptual and implementation views of most common data structures and algorithms. It also goes over the Java Collections (such as List, ArrayList, LinkedList, Set, HashSet, TreeSet, Map, HashMap, TreeMap, and PriorityQueue) to solidify understanding of data structures. There is an introduction to the analysis of algorithms that operate on them. Following learning-by-doing methodology, there will be many repetitions of writing code and reviews of the topics covered in lectures.

### Objectives

- Acquire an understanding (design, analysis, and implementation) of basic data structures and their major operations and fundamental algorithms.
- Provide an introduction to algorithm efficiency and complexity in terms of running time and space.

### Background and Motivation

As a Java application programmer, you may often use the Collections Framework that provides a well-designed set of interfaces and classes for storing and manipulating groups of data. But, you may not really think about what is in there and how it works.

This course is designed to take a closer look at the Interfaces and Classes in the Framework so that you can have a better understanding of core data structures and major operations on them.

Also, having a good habit such as following a good coding style and adding meaningful comments as you write a program is a great skill to learn as a programmer. Thus, examples in lectures and labs will demonstrate a better, if not the best, habit. There will be many practices to write code on papers in lectures, labs, quizzes, and homework assignments.

### Instructor

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## Grading & Cheating

You are responsible for being familiar with the university standard for academic honesty and plagiarism.

<http://www.cmu.edu/policies/student-and-student-life/academic-integrity.html>

Please see the CMU Student Handbook for information. **In order to deter and detect plagiarism, we will be using the Moss system.** All of the instructions about homework assignments will be posted on Canvas and instructions about lab will be handed out to you during the lecture. Most homework assignments and labs are handed in using the tool, Autolab (<https://autolab.andrew.cmu.edu>).

Students caught cheating or plagiarizing will receive ***no credit for the homework, the quiz or the exam on which the cheating occurred***. Additional actions, including assigning the student a failing grade in the class or referring the case for disciplinary action, may be taken at the discretion of the instructor.

***If you have any questions about labs or homework assignments, you may post them on Canvas.*** A Piazza forum is there for this purpose.

If you have a question concerning the specific code you wrote, **please do not post your code on Piazza**. Instead, see the teaching assistants or the instructor for help or email one of us. Please keep questions on Piazza to be more general ones about your assignments (e.g. "What does this error message mean?" or "In the assignment note, what does copying elements in an array mean?" etc.)

The following are considered cheating:

- Discussing code
- Showing anyone your code
- Looking at anyone else's code
- Having anyone else produce code for you
- Having anyone else correct your code for you
- Copying code you find on the web

***You are not permitted to be in possession of any assignments, source code files, quizzes or exercises, exam from another student either from the current semester or from past semesters whether they are electronic or paper. Possession of or sharing such files constitutes an infraction of the academic integrity policies of this course.***

**MINIMUM** penalty for copying files: Zero for that assignment (and 50% penalty for the source). You may also get reported to the university administration. **DO NOT CHEAT!**

Your final grade will be based on (subject to change):

Labs	21% of grade (3% each for 7 labs)
Homework	25% of grade (4% each for the first 5 and 5% for the last homework)
Quizzes	20% of grade (4% each, <i>the lowest score will be dropped out of 6 quizzes</i> )
Final Exam	34% of grade

### Copyright Violations

You can take copies of course materials **only for personal use**.

- This applies especially to the lecture notes.
- This also applies to the course examples.
- Do not make any course materials available to the public (especially on the Internet such as discussion forums or your blogs, etc.).
- Do not put course materials into public repositories (GitHub, BitBucket, etc.)

## Materials

Textbook: There is no required textbook for this course. An optional textbook is Data Structures and Algorithms in Java (2nd Edition) by Robert Lafore.

A copy of the textbook is on reserve at Sorrells Engineering and Science Library in Wean Hall.

You can find the book by going to <http://www.library.cmu.edu/using/reserves> and searching under my name (Terry Lee) or the course number (08-722).

## Lecture

In every lecture, there will be an introduction to one or two data structures and questions that we will try to answer together using the introduced data structures. For every lecture, there will be a lecture note in which you will fill additional information or ideas at your discretion in class. In the lecture, we will mainly focus on both the conceptual view and the implementation view of each data structure.

Research on learning shows that unexpected noises and movement automatically divert and capture people's attention, which means you are affecting everyone's learning experience if your cell phone, pager, laptop, etc. makes noise or is visually distracting during class.

*For this reason, we allow you to take notes on your laptop, but insist that you turn the sound off and sit in the last row so that you do not disrupt other students' learning. You are not allowed to use your smartphone no matter where you sit.*

## Lab

Labs are designed to review the most important concept covered in the previous lectures and apply it to solve a specific problem. In every lab, there will be some questions to be answered and also some sample code will be provided to you.

You should be able to analyze and modify/adjust them as necessary. The focus is more on the implementation view of data structures and using them to solve problems. *Please use **JAVA 8** for your lab. Do not put your code into public repositories (GitHub, BitBucket, etc.)*

## Homework

There will be weekly homework assignments. More specifically, there will be 6 homework assignments and you are to solve quite similar problems using different data structures and algorithms so that you have a few chances to think differently and creatively. **To mimic the real-world environment, the requirements (specifications) for assignments are not 100% clear.** Please ask questions on Piazza and during office hours to make sure you get more information as needed.

Please use **JAVA 8** for your homework. Do not put your code into public repositories (GitHub, BitBucket, etc.) or your own blogs, etc.

#### Quizzes and exam

***There will be NO make-up quizzes and exams!***

- Quizzes: There will be weekly quizzes. These will be held during the last 15 to 20 minutes of the class period. The questions are meant to test not only your understanding of concepts but also your problem solving skills within a very short period of time. ***If you miss a quiz, you will be given a 0% for that quiz.***
- Final exam: The final exam will be also a written and in-class exam that will cover all the materials in lectures, labs, quizzes, and homework assignments. More information will become available as the course gets closer to the exam. **It is an 80-minute exam and will be at 6:30pm on May 8<sup>th</sup>, 2018 (Tuesday). The location will be announced later. Note: if your grade option is Pass/Fail, you may be asked not to come to take the final exam. So, to be able to take the final exam for sure, you must take this course for a letter grade.**

**Schedule** (Subject to change)

Week	Date	Lecture Topic	Quiz/Lab	Assignment
week 1	03/20/2018	Lecture 1: Big Picture Lecture 2: Java Collections Lecture 3: Arrays and Linear Search		
	03/22/2018	Lecture 3: Arrays and Linear Search (cont'd) Lecture 4: ArrayList and Binary Search	Lab 1: ArrayList time comparison and String Manipulation	Homework 1 (due by Mar 29)
week 2	03/27/2018	Lecture 5: LinkedList	Quiz 1	
	03/29/2018	Lecture 6: Stack Lecture 7: Queue	Lab 2: LinkedList Operation	Homework 2 (due by Apr 5)
week 3	04/03/2018	Lecture 8: Simple Sorting	Quiz 2	
	04/05/2018	Lecture 9: Comparable/Comparator Lecture 10: Recursion	Lab 3: Simple Sorting, Comparable/Comparator	Homework 3 (due by Apr 12)
week 4	04/10/2018	Lecture 10: Recursion (cont'd) Lecture 11: Hashing	Quiz 3	
	04/12/2018	Lecture 11: Hashing (cont'd) Lecture 12: HashTable	Lab 4: Recursion	Homework 4 (due by Apr 24)
week 5	04/17/2018	Lecture 13: HashSet, HashMap Lecture 14: Advanced Sorting	Quiz 4	
	04/19/2018	<i>No Class</i>	<i>Spring Carnival</i>	<i>Enjoy!</i>
week 6	04/24/2018	Lecture 14: Advanced Sorting (cont'd)	Lab 5: Advanced Sorting	Homework 5 (due by May 1)
	04/26/2018	Lecture 15: Binary Trees	Quiz 5	
week 7	05/01/2018	Lecture 15: Binary Trees (cont'd) Lecture 16: Huffman Coding Lecture 17: TreeSet, TreeMap	Lab 6: Binary Trees	Homework 6 (due by May 8)

	05/03/2018	Lecture 18: Heaps, HeapSort	Quiz 6	
week 8	05/08/2018	Final exam	Lab 7: Heaps	Lab 7 (due by May 10)

***Take care of yourself.*** Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

*If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night:*

**CaPS: [412-268-2922](tel:412-268-2922)**

**Re:solve Crisis Network: [888-796-8226](tel:888-796-8226)**

***If the situation is life threatening, call the police:***

**On campus: CMU Police: [412-268-2323](tel:412-268-2323)**

**Off campus: 911**