1. Basics

Course details:	CS 201 (Data Structures); Spring 2018, Carleton College
Meeting times:	6a (MW 15:10–16:20, F 15:30–16:30); CMC 301
Instructor:	Jed Yang, CMC 324, x4473, `jyang@carleton.edu`
Office hours:	Mon. 16:20–17:20 (in CMC 306), Thr. 14:35–15:35, Fri. 13:00–14:00; or by appointment
Prefect:	Maryam Hedayati (`hedayatim@carleton.edu`)
Webpage:	`http://cs.carleton.edu/faculty/jyang/cs201.18s/`

2. Course information

Official course description. Think back to your favorite assignment from *Introduction to Computer Science*. Did you ever get the feeling that "there has to be a better/smarter way to do this problem"? The *Data Structures* course is all about how to store information intelligently and access it efficiently. How can Google take your query, compare it to billions of web pages, and return the answer in less than one second? How can one store information so as to balance the competing needs for fast data retrieval and fast data modification? To help us answer questions like these, we will analyze and implement stacks, queues, trees, linked lists, graphs, and hash tables.

Prerequisites. CS 111 or instructor permission. No previous Java experience is necessary.

Course goals. This is typically the second computer science course at Carleton, following CS 111 or an introductory course you took elsewhere. In this course, you will be learning about how to work with data, how to design solutions that are efficient for a particular application, and developing more complex programs than in an introductory CS course. We will be learning the programming language Java as a consequence of our exploration of these ideas. By the time you have completed the course, you will be able to:

- Work with basic programming building blocks (data structures and abstract data types), including linked lists, arrays, stacks, queues, trees, graphs, and hash tables.
- Analyze "mathematically" the efficiency, strengths, and shortcomings of algorithms and of data structures.
- Create non-trivial Java programs and apply basic good software engineering practices, including modularity, interfaces, and debugging.

Whether or not you are interested in taking future computer science courses, this class should help you to develop your problem solving and analysis skills as well as learn coding skills that you can apply in a variety of domains. If you are interested in more computer science courses, *Data Structures* will prepare you for almost any other upper level course here at Carleton, and give you a foundation in some of the ideas underlying much of the field.

Textbook. *Data Structures and Abstraction with Java*, 4th edition, Frank Carrano and Timothy Henry, 2015.

3. Universal Learning

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions will be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning.

Carleton College is committed to providing equitable access to learning opportunities for all students. The Disability Services office (Henry House) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (*e.g.*, mental health, attentional, learning, autism spectrum disorders, chronic health, traumatic brain injury and concussions, sensory, or physical), please contact Chris Dallager, Director of Disability Services, by calling 507-222-5250 or sending an email to `cdallager@carleton.edu` to arrange a confidential discussion regarding equitable access and reasonable accommodations.

4. Course components and evaluation

Your grade will be determined by a weighted arithmetic mean of various components with weights listed in the table on the right. In more detail: (a) I record a numerical score for each component (possibly adjusted so that different components are on comparable scales). (b) For each student, I calculate the weighted arithmetic mean. (c) I sort these overall scores in descending order. (d) Except in very unusual circumstances (*e.g.*, medical or other personal-life issues that affected a particular score) I assign letter grades strictly based on this sorted order.

component	weight
Participation	10%
Homework	40%
Midterms	30%
Final Exam	20%

There is no standard percentage that I associate with a particular letter grade (`A`, `B`, `C`, *etc.*). Instead, I decide on letter grade cutoffs by comparing each student's overall score to my understanding of the Platonic ideal of an x student (for $x \in \{\texttt{A}, \texttt{A-}, \texttt{B+}, \ldots\}$). To make the grades robust to small noise, I also look for large numerical gaps in the sorted list of scores when setting grade cutoffs.

Note that therefore *you should not care how difficult the exams (or homework assignments) are.* Indeed, the Platonic `A` student earns fewer points on a more difficult exam than she does on an easier exam. In fact, in many courses I intentionally make one exam harder than the others, which gives me information (in a mathematical sense) in separating an `A` performance from an `A-` performance.

There is also no preset curve of how many of each letter grade will be given. As such, *you are encouraged to help each other in the pursuit of perfection.* If you all do `A` work, you will each get an `A`. Feel free to talk to me if you are concerned about your standing in the class, with the understanding that given the nature of the aforementioned grading process, it is impossible to accurately predict your course grade before the final exam.

5. Participation and class structure

Participation is an integral part of the learning experience. In class, we will do some interactive activities, and even when I am doing most of the talking, I still expect you to think about and respond to questions. Class will be much more enjoyable and useful to you if you come prepared and take on an active role.

Reading before class. To adequately prepare for class, you are required to complete specific reading assignments or exercises before each class meeting. Unless otherwise stated, after you complete the reading, **post a question or comment to the Readings Forum on Moodle.** The earlier you post, the more opportunity others can respond to your post, and the better I can prepare for class and address any lingering points of confusion, so it is to your benefit to not leave these until the last minute. As such, completion of these reading assignments **two hours before class** will make up the bulk of your participation grade.

Grading. Participation is graded on effort (rather than correctness) of the following items:

- daily readings, mostly measured by Forum posts,
- a few surveys, and
- a few miscellaneous items.

The on-time **completion** of 80% of these items will give you 80% of your participation grade. The remaining 20% will be based on your engagement in the classroom. It is my hope that every student attains full credit in this component.

Attendance. I expect you to attend class. You may not notice me taking attendance during class meetings, but I will notice if you are not in class. Occasional absences will not impact your grade because what I look for is not mere attendance, but engagement and participation.

Indeed, coming to class is not just about showing up; it is also about being fully engaged in the learning experience. If you have a question, others in the class may also be wondering the same thing. So, please speak up and ask questions anytime you need to. Not only will you be helping yourself, but also you will be helping your peers. Attending office hours is another great opportunity to ask questions.

Be mindful of others. Refrain from using mobile phones or laptops for activities unrelated to the learning process. If you prefer to use laptops to take notes, please kindly sit in the back, as the screen may distract others.[1] There is research that suggests taking notes by hand is better for long-term retention.[2]

Illness. You should make every effort to attend class when you are healthy. If you become ill, for your well-being and the well-being of the rest of the class, you should not come to class. (Nor should you show up in my office with your germs!) Yes, this sounds like common sense, but it is tempting to try and power through as normal so as not to fall behind, particularly at a place like Carleton. If you become ill, or know that you will need to miss class for some reason, please contact me as soon as you are able, and we will work together to plan how you will keep up and/or make up any missed work.

6. OTHER COURSE REQUIREMENTS

Homework. Homework assignments will be a mix of coding, analysis, and paper-and-pencil exercises. Some assignments will be **solo assignments**, meaning you can discuss the project with others, but you are responsible for writing your own work. Other assignments will be **pair programming assignments**. For these, I will assign partners. You will switch partners several times throughout the term. I strongly encourage you to start on homeworks early. Typically, assignments are due at 22:00. See below for more detailed policy regarding homework.

Exams. There are two in-class midterm exams (tentatively scheduled for **Friday of Week 4** and **Friday of Week 8**), weighted equally. The second exam will mainly focus on the material covered since the first exam, but can include previous material too. There will be a final exam during our final exam period covering the entire course. (I reserve the right to make the final self-scheduled.)

Time outside of class. Like other Carleton courses, I expect that you should be spending about 10–12 hours per week on this course outside of class. Some students need to spend a bit more than that (which is okay). If you are spending more than 15 hours per week on this course outside of class time, please come talk to me so we can find ways to help you learn the material without spending so much time.

7. HOW TO GET HELP

If you need help there are multitude of resources you can use:

(a) **Yourself.** If you're stuck on a problem or struggling with a concept from class, take a break and think about something else (*e.g.*, your Greek assignment, the economics of *Star Trek*) for a few hours and then try a fresh start.

(b) **The book.** There is a lot of really useful information in it. Peruse it at your leisure.

(c) **Your classmates.** You are each other's best resource: talking through the course material with someone else who is also trying to master it is a great way for you both to learn. (And don't discount the learning that you will do while trying to explain to a classmate an idea covered during class that you think you understand; I can't count the number of times that I've discovered that I didn't really understand something until I tried to teach it to someone.) The homework assignments are meant to challenge you, and figuring some of them out together is a great approach.

(d) **The prefect.** Attend a prefect session to get help with homework or general concepts.

(e) **The instructor.** Come to my office hours or email to make an appointment. (Please include a list of a few times that you will be free to meet, and give me at least 24 hours of lead time.) I will consistently reserve Tuesdays for research, and I do not schedule office hours or make appointments for that day. I have this scheduled "research day" so that I can work on my research projects in an uninterrupted block of time. Without reserving a large block, I won't have time for any research. Thursdays 11:30–16:00 are usually good times for me.

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[1]See http://tinyurl.com/laptops-degrade-nbrs-grades.

[2]P. A. Mueller and D. M. Oppenheimer, The pen is mightier than the keyboard: advantages of longhand over laptop note taking, *Psychological Science* **25** (2014), 1159–1168.

(f) **The Moodle forum.** Personal questions (*e.g.*, regarding grades) should be elsewhere, but all other questions (*e.g.*, course content, homework, logistics) should go here rather than sending me email. I will periodically respond on the forum, but also please help answer each other's questions! While I try to answer queries about homework within 24–48 hours, I cannot always make this timeline, and you should not rely on faster responses than this. Among other things, this means that you would be well advised to ask any questions of clarification earlier than the day before an assignment is due.

(g) **College-wide resources.** The library, the Academic Skills Center, the Math Skills Center, the CS lab assistants (in CMC 102, 304, 306), *etc.*

8. Homework policy

Collaboration. Many of the assignments in this class will be collaborative. You can learn a lot from working directly with your peers. However, make sure that you are familiar with the collaboration policy outlined at the end of this syllabus. Working with a partner does not mean just dividing up the work. You are responsible for knowing and being able to explain any part of an assignment that you turn in. For solo assignments, you can certainly discuss the project with your classmates, but the work you turn in must be done by you alone.

Partners. I will assign partners for pair programming assignments. In paired programming, you DO NOT simply divide up the work and work separately. Instead, you and your partner are always working together, side by side, with one of you typing ("driving") and one of you looking on and providing feedback ("navigating"). You will switch between these two roles often. Paired programming generally leads to better designed code with fewer errors. Please look at the course website for more details about paired programming.

When emailing me regarding homework, including questions or meeting requests, please carbon-copy ("Cc:") your partner. This way, I can reply to both of you without having to look up your partner's email address.

Grading. Each assignment will include some information about the number of points the assignment is worth and how those points will be allocated. If you have a question about how a homework assignment was graded, please start by talking to the grader. If you cannot resolve the question, you may request that I look at the question.

Late work policy. You are allowed up to three (3) late assignment-days throughout the term for homework. (A **day** is 24 hours, regardless of weekends and holidays.) This allotment is to cover for legitimate reasons for tardiness that may arise. No explanation for the tardiness is necessary or desired, but please do inform me (in person in class is fine) that you are submitting an assignment late. After the freebies, work handed in late will receive zero credit. If you use a late day for a partnered assignment, you both use a late day. If you wish to use more than one late day for a single assignment, please discuss with me first. Late days may not be used for extensions beyond the final day of classes. To be fair to everyone in the class, I will generally not grant additional extensions without the intervention of a doctor or class dean. But if a genuine emergency situation arises, please talk to me.

9. Academic honesty and collaboration policy

Collaborative work is an integral part of many successful ventures. As such, I expect that you should collaborate with your classmates a lot during your time in this course. However, it is important to understand that there is a big difference between thinking about and solving a problem as part of a group (which is good, both educationally and morally) and copying an answer/code or letting someone else copy your answer/code (which is bad, educationally and morally, and has punitive consequences). Below are a few specific examples of unacceptable behaviour in this course:

- Modifying someone else's code and putting your name on it.
- Having a friend debug your code and then turning in the revised code.
- Asking a homework question on a forum and then turning in the answer as your own.

- Looking at code samples (except the textbook) that are longer than a few lines.
- Seeking out resources from past versions of this course or similar courses offered elsewhere.

In short, ***I trust you to maintain the utmost level of academic integrity in this course.*** Please do not break this trust; if you do, there will be repercussions. The formal policy below lays this out explicitly, and supplements the College's academic integrity policy and the Dean of the College's detailed guide to academic integrity.

Collaboration policy: You may collaborate on the homework assignments to the extent of formulating ideas as a group, but you may not collaborate in the actual writing of solutions/code (unless explicitly allowed in the instructions). In particular, you may not work from notes taken during collaborative sessions. You *must* cite all sources, including websites and classmates from whom you obtained ideas. You may not consult any materials from any previous offerings of this course or from any other similar course offered elsewhere.

You are required to completely understand any solution that you submit and, in case of any doubt, you must be prepared to orally explain your solution to me. If you have submitted a solution that you cannot verbally explain to me, then you have violated this policy.

Of course, there is to be no collaboration whatsoever on any exams. Policies for what constitutes acceptable reference material, if any, will be specified in detail when the exam is distributed.