SMU | Bobby B. Lyle School of Engineering

Data Structures

CS 2341 – Fall 2021

Introduction:

Welcome to Data Structures! During this semester, we will delve into the world of object oriented C++, data organization and access, and associated software development topics. A major aspect of computer science is finding an efficient solution to a given problem that can be implemented on a computer. We will explore some of the more intermediate and advanced parts of the C++ language and how they can be leveraged in construction and implementing various data structures and algorithms to operate on those data structures. We will also begin to explore how data organization and access can enhance or inhibit the efficiency of a solution to a problem.

As a similar saying goes, programming languages are to computer science what hammers are to carpentry. Programming is a tool that we use to communicate with a computer and express our solutions to problems. It is important to know how to use this tool efficiently to solve complex problems. To get the most out of this class and ultimately to be successful, you must be willing to work hard.

Instructor Information:

Mark Fontenot, Ph.D.
Office: Caruth 433
mfonten@lyle.smu.edu
214.768.2854 (please use email for routine contact)
http://lyle.smu.edu/~mfonten http://markfontenot.net
Office Hours:

- Thursday 10 - 11:30 am Caruth 433
- It is impossible for me to find a time that works for everyone. So please, always feel free to message me on Slack or send me an email and we can set a time to meet. Usually, we'll be able to find a window in the next 24 hours.

Course Information:

Lecture:

MWF	11-11:50	Caruth 147 - Vester Hughes Auditorium

Lab Sections:

N11:	W 8-9:50	Junkins 102
N12:	Th 3-4:50	Embrey 123
N13:	F 3-4:50	Junkins 102
N14:	Tu 5-6:50	Caruth 485
N15:	Th 1-2:50	Embrey 123
N16:	W 4-5:50	Embrey 123

Catalog Description:

Emphasizes the object-oriented implementation of data structures, including linked lists, stacks, queues, sets, and binary trees. The course covers object-oriented software engineering strategies and approaches to programming in interdisciplinary teams.

Where to Find Info:

Course Management:	We'll be using Canvas. You can access it via http://smu.instructure.com
Handout Locations:	markfontenot.net
Quick Communication:	Slack
Project Submissions:	github.com
Project Grading:	codePost.io

Recommended Textbooks:

The material covered in this course has been refined over the past 10+ years. To date, I have not found a textbook that covers all the topics we are going to cover. Additionally, students must learn to teach themselves and to find relevant information on a topic. Every bit (no pun intended) of the content knowledge that we will cover is somewhere on the web. Each topic is likely covered hundreds or thousands of times there. I encourage you to use your web savvy in this course.

You're encouraged to make extensive use of your Googling (or other search engines) skills and abilities. Read about the topics we cover. Read several different explanations. Read until you begin to understand. Read Wikipedia articles. Read Medium articles. Watch YouTube videos.

However, below are some optional books if you are interested in having a physical text.

Data Structures Topics:

- Weiss, MA. *Data Structures and Algorithm Analysis in C++, 4th ed.* Pearson. ISBN-13: 978-0132847377

C++ Topics:

- Materials from CS 1342 are always a great resource.

- Gottschling, Peter. Discovering Modern C++: An Intensive Course for Scientists, Engineers, and Programmers. Addison-Wesley Professional. ISBN: 0134383583.

- Stroustrup, Bjarne. A Tour of C++, 2nd Edition. Addison-Wesley Professional. ISBN: 0134997832

Prerequisite

C- or better in CSE 1342 or equivalent or permission of instructor.

Learning Outcomes:

1. Ability to properly handle dynamic memory management tasks in c++
2. Ability to compare data structures and their algorithms analytically and experimentally
3. Ability to implement a range of data structures including but not limited to linked lists, stacks, queues, binary search trees, hash tables, and heaps
4. Ability to compare and contrast various comparison-based sorting algorithms
5. Ability to decompose and solve large problems
6. Ability to choose appropriate data structures to solve a problem
7. Ability to design, implement, test, and debug classes in C++

Method of Evaluation:

The final course grade in CSE 2341 will be based on the performance of various deliverables such as implementation projects and homework assignments. Additionally, your attendance and active participation in lecture and lab will be reflected in your final grade. The percentage breakdown is as follows:

Evaluation Tool	**Percentage**
Midterm	15%
Final Exam	15%
Programming Assignments (4 each evenly weighted)	32%
Semester Project	20%
Homework Assignments and Quizzes	10%
Professionalism	8%

I believe in learning by doing, and there is substantial research to support learning-by-doing as valid and relevant. We will routinely jump back and forth between the abstract/theoretical and applied domains. You will complete a number of programming projects that will require substantial time investments. The material covered in this course, however, is often used in technical interviews for internships and full-time positions. So it is vitally important that you master it. **The final exam for this course may take the form of a mock technical interview or a written exam**.

The due dates for all assignments will be explicitly stated on each assignment and will be available on the course website and Canvas. Final grades in this course are determined as follows:

94 - 100 : A	90 - 93 : A-	
87 - 89 : B+	83 - 86 : B	80 - 82 : B-
77 - 79 : C+	73 - 76 : C	70 - 72 : C-
67 - 69 : D+	63 - 66 : D	60 - 62: D-
0 - 60 : F		

Additional grade stipulations and notes:

- In order to get a grade above a D+ in the course, you must:
    - maintain a passing average (>60%) on all regular programming assignments including the final project, and
    - have a midterm + final average >60%.

Homework Assignments & Quizzes:

Homework assignments are assigned throughout the semester. Quizzes may be announced or unannounced. Homework assignments will be available via Canvas and/or will be handed out in class. Each will clearly state the due date and method of submission.

Programming Projects:

Nearly every week, you'll be working on some aspect of a programming assignment in and out of your lab period. You will not be able to finish an entire assignment during lab time; if you do, you should question whether or not you actually fulfilled the requirements. Further, your lab period is not the time to start your work for the week. You should work on your assignments before lab and use lab as time to get clarifications and explanations as needed from the TAs. Each lab packet will clearly state the due dates for each of the deliverables.

Submission Deadlines:

Rather than penalize late submissions, you will be rewarded for early submissions. Programming projects (except for the final semester project) will be eligible for **10% extra credit** for submitting the project **at least 48 hours early**. Recognizing that sometimes things happen at the last minute that are beyond our control, each student will get one (1) two-day (2-day) “free” extension - no questions asked. This means you can submit this one project (except for the final semester project) up to 48 hours late.

If/when you want to use your one extension, send an email to Dr. Fontenot and TA Eric Miao. The email should include your:

- Name,
- ID Number, and
- on which project you’re asking for an extension.

General Requirements for all Programming Projects:

All projects will be reviewed, evaluated, and graded using the programming environment detailed by the course staff. Your submission must conform to the specifications in each project handout. Each submission is required to use the specified build system to compile and run your projects. The specifics for this will be covered in a separate handout.

Project submissions that do not build/compile using the above stated build system and that stated in associated course handouts including any modifications to the build system as stated in each individual project handout will receive no credit. No matter how much time you spend writing code, if it doesn't build/compile, you will receive NO credit.

We will use GitHub throughout the semester as a code versioning and backup tool as well as the platform for final submissions. If used as instructed (and as GitHub is intended), you will always have a safe and secure backup of your source code. Therefore, **I will entertain no excuses related to computer hardware failure for not submitting projects or assignments on time**.

Communication, Attendance, and Grading:

Because of the nature of this class, attendance and participation in lectures and labs are very important. I expect you to attend all classes and lab sessions. If you are absent from class, it is your responsibility to make arrangements with me to make up any work missed or to ensure that assignments are submitted on time or early. ***Except as stated above in Programming Projects section, no late work will be accepted.*** Any assignments that will be missed (including those due to university-sanctioned events) must be completed ***before the due date***. This includes projects, exams, and homework assignments.

Note that a portion of the semester grade is based upon class attendance and active participation. This attendance score will be determined based on attendance and active participation in both lecture and lab. Attendance in lecture will be randomly taken. Lab attendance will be taken weekly. After three missed lab or lecture classes, one percentage point will be deducted from your final course average for each missed class or lab missed up to the max listed in the table above.

Any issues with grades assigned on projects, homework, quizzes, exams or any other graded materials must be brought to Dr. Fontenot's attention within 48 hours of the grades being posted on Canvas, or they will not be entertained. This should be done via email.

A college course is taught by a professor and attended by a student. So, the educational engagement is between the two of us, and informed by the course staff of graduate and undergraduate teaching assistants. This educational engagement does not include your parents, guardians, or others in any way. Therefore, I will only be communicating with you. I will not be communicating with your parents or guardians in any way, regardless of the presence of a FERPA release that you have issued.

Outside Work:

This course will require a substantial amount of work outside of class. The best way to learn this material is to sit down, get comfortable, and just do it. There will be several programming assignments and projects that will require a great deal of time. Some of these projects may be collaborative in nature. It is reasonable to expect that you may spend 10 or more hours per week outside of lecture/lab working on programming projects for this class.

Here are some soft-skills that we hope to help you hone over the course of the semester:

- Time Management (i.e. not waiting until the last minute to begin work on projects and assignments)
- Work smart by using your time wisely and using tools related to the course material effectively
- Large-scale problem solving (i.e. planning and designing before coding)

Academic Ethics and Collaboration:

I take academic ethics very seriously. Each of you should have read the SMU Honor Code by this point in your academic career at SMU. What you submit for any course deliverable must be your own intellectual work product, except where collaboration with other students is explicitly allowed, and you must be able to defend any of the work submitted (ie. explain it in sufficient detail). The metadata associated with your work product (file timestamps, commit logs from GitHub, etc.) are also part of your work and will be treated as such. Any modification of these metadata done to intentionally mislead one of the course staff members will be treated as a cheating offense.

You are expected to create, edit and print your own assignments and take tests without outside assistance. All work is expected to be your own. In particular:

- You should never look at or review another person's work for any given assignment. This includes looking at papers, solutions, or computer screens where another student's work is displayed. This also includes solutions from previous semesters.
- You should never give or receive solutions/answers to any questions or projects or any parts or questions or projects. This includes but is not limited to source code, design documents, homework, etc.
- In the header comments of your source code, you must reference online sources you consulted to complete the project. This is especially important if you've "quoted" source code.

If you collaborate on any assignment for any reason unless specifically permitted by the instructor, you will receive an F in the course and may be brought in front of the SMU Honor Council. The presumption should be that collaboration is not permitted and collaboration should only take place subsequent to explicit instructions by the course instructor. It is your responsibility to know and understand the University's Honor Code and the expectations for collaboration in this course. Dr. Fontenot reserves the right to impose less severe penalties at his sole discretion.

Words of wisdom: ***The penalty for academic dishonesty will always be more severe than simply not submitting the assignment.*** Not turning in an assignment will result in a zero on that assignment. Engaging in academic dishonesty related to that assignment will likely result in an F in the entire course and/or referral to the honor council.

So, what is explicitly permissible? I will be the first to agree that sometimes we learn better when we are talking through things. When a project is assigned, you are certainly allowed to 'whiteboard' design ideas, high level plans, etc. But they should never get to the level of code. If you have questions about what is allowed or not allowed, please just ask Dr. Fontenot.

Conduct Expectations:

Students shall observe the following:

- Using a laptop in class is a privilege; it is not a right. When laptops distract your or other students in the class you will no longer be allowed to use them. I reserve the right to ask to see your screen and class notes taken during class to determine if you are using your laptop appropriately.
- Cell phones should be in vibrate/silent mode at all times during lecture. If your cell phone does not have this feature, then it should be turned off. DO NOT answer your cell phone during class.
- Sending text messages, surfing the Internet, playing games, reading the newspaper, etc. is considered disrespectful and will be dealt with accordingly. You are not only disrespecting the instructor, you're also distracting students around you whether you think so or not.
- Students should remain quiet during lecture so as to avoid disturbing other students.
- Yawning out loud is disrespectful!

Course Masking Policy:

As of Aug 20, 2021, there is a general campus-wide masking policy which you can find at. https://www.smu.edu/Coronavirus/Healthy-Campus.

Additionally, masks are required in this course. This masking policy is subject to change during the semester, and any changes will be posted clearly in Canvas announcements. Mask wearing in this class is included as one of the expectations of maintaining professionalism within a culture of respect, such that a failure to follow the classroom requirements would negatively impact the overall professionalism/participation grade for up to 8% of the final course grade.

Tentative Schedule of Topics

This schedule is tentative and *subject to modification* throughout the semester.

Week Of:	Topics:	Prog Assignments:
Aug 23	Getting Started, c-strings and Wrapper Classes for DSString	Wed - PA01 out
Aug 30	Operator Overloading; Pointers Review and Memory Management	
Sept 6	Monday Holiday Memory Management in the Context of Linear Data Structures	
Sept 13	Memory Management in the Context of Linear Data Structures	Monday: PA 01 Due; PA 02 Out
Sept 20	Algorithm Analysis	
Sept 27	Sorting Algorithms and their Analysis	Monday: PA02 Due; PA 03 out
Oct 4	Introduction to Trees	Saturday PA 03 Due
Oct 11	M/Tu - Fall Break Wednesday - Midterm Review **Friday - Midterm Exam**	Wed: PA 04 Out
Oct 18	Balanced Trees	
Oct 25	Balanced Trees	
Nov 1	Hash Tables	Monday: PA 04 Due; Final Proj Kickoff
Nov 8	Heaps	
Nov 15	Sets	
Nov 22	Graphs; Thanksgiving Holiday	Mon & Tues: Final Project Sanity Check/Timing Check
Nov 29	Graphs	
Dec 6	Final Projects	**Mon - Final Project Demos**
Dec 9 - Dec 15	**Oral Final Exams**	

There will be a final exam for the course, and it has historically been an oral final. *Before you make travel plans for the end of the semester, check with Prof. Fontenot about the dates for the final*.

Standard SMU Syllabus Language

Disability Accommodations:
Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit http://www.smu.edu/Provost/SASP/DASSto begin the process. Once approved and registered, students will submit a DASS Accommodation letter to faculty through the electronic portal *DASS Link* and then communicate directly with each instructor to make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

Religious Observance:
Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence.
(https://www.smu.edu/StudentAffairs/ChaplainandReligiousLife/ReligiousHolidays).

Excused Absences for University Extracurricular Activities:
Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation.It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (See 2021-2022 SMU Undergraduate Catalog under "Enrollment and Academic Records/Enrollment Policies/Excused Absences.")

Caring Community Connections (CCC) Program:
This is a resource for anyone in the SMU community to refer students of concern to the Office of the Dean of Students. Faculty play a critical role in identifying students who are experiencing challenges, as you may be the first to notice a change in behavior such as class attendance or performance. The online referral form can be found at smu.edu/deanofstudentsccc.After a referral is submitted, students will be contacted to discuss the concern, strategize options, and be connected to appropriate resources. Additionally, should you have concerns about students and are unclear about what to do, please see the CCC Reference Guide,or contact the Office of the Dean of Students at 214-768-4564

Accommodations for pregnant and parenting students:
Under Title IX students who are pregnant or parenting may request academic adjustments by contacting Elsie Johnson (elsiej@smu.edu) in the Office of the Dean of Students, or by calling 214-768-4564.Students seeking assistance must schedule an appointment with their professors as early as possible, present a letter from the Office of the Dean of Students, and make appropriate arrangements. Please note that academic adjustments are not retroactive and, when feasible, require advance notice to implement.

Sexual Harassment:
All forms of sexual harassment including sexual assault, dating violence, domestic violence and stalking are violations of SMU's Title IX Sexual Harassment Policy and may also violate Texas law.Students who wish to file a complaint or receive more information about the grievance process may contact Samantha Thomas, SMU's Title IX Coordinator, at accessequity@smu.eduor 214-768-3601.Please note that faculty are mandatory reporters.If students notify faculty of sexual harassment, they must report it to the Title IX Coordinator.For more information about sexual harassment

Campus Carry:
In accordance with Texas Senate Bill 11, also known as the "campus carry" law, following consultation with the entire University community SMU determined to remain a weapons-free campus. Specifically, SMU prohibits possession of weapons (either openly or in a concealed manner) on campus. For more information, please see: http://www.smu.edu/BusinessFinance/Police/Weapons_Policy.