CS 2413: Data Structures
Spring 2024

Instructor: Beiyu Lin
Office: Devon Energy Hall 235
Email: beiyu.lin@ou.edu
Class time: M/W: 1:30-2:45 pm
Office hours: M/W: noon-1:15pm
TA: Narayan Kirankumar (narayan.soni@ou.edu)
Subankar Chowdhury (Subankar.Chowdhury-1@ou.edu)
Reza Gheibi (rezagheibi@ou.edu)
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TA Office hours:
Narayan Soni: TR: 2:00 - 3:30 pm
Subankar Chowdhury: T: 11:45 am - 1:00 pm, W: 8:00 am - 9:15 am.
Reza Gheibi: T: 3:45 pm - 6:15 pm

TA Office hour's location: Devon 115

CatalogDescription
algorithm complexity, sorting algorithms, lists, stacks, queues, search trees (AVL, Red-Black, Splay, 2-3), Heaps, Graphs, and Hashing. Prerequisite: C S 2334 and MATH 1823 or 1914; and C S 2813 or MATH 2513, or concurrent enrollment in C S 2813 or MATH 2513.

Required Text:
- Data Structures and Algorithm Analysis, Edition 3.2 (C++ Version) Clifford Shaffer (PDF available)

Outcomes Covered by This Course
- Outcome C: Apply computer science theory and mathematical models to comprehend the trade-offs involved in various design choices

  ◦ **Course Objectives and Expected Learning Outcomes**
     Upon completion of Computer Science 2413, participants will be able to understand:
     ▪ Sorting and searching models and algorithms including the associated trade-offs and asymptotic complexity
     ▪ Computer science theory of basic data structures (stacks, queues, trees, heaps, hash tables, and graphs)

  ◦ In addition, for all courses involving programming, participants should be able to:
     ▪ Develop algorithmic solutions to problems and translate their algorithms into programs that meet a provided set of specifications
     ▪ Demonstrate and use good programming style and adequately document programs

Prerequisites
To qualify for this course you must have earned a C or better in CS 202 (Computer Science II) and a C or better in MAT 181 (Calculus I).

Grading

Grades will be based on:	20 Assignments	70%
	Midterm	15%
	Final Exam	15%

Grades will be posted throughout the semester.
Grading is as follows:

$$A (\infty,90]; B (90,80]; C (80,70]; D (70,60]; F (60,0]$$

Exam Dates
• Midterm – Wednesday March 13th
• Final – Wednesday Monday 9th 8am-10am.

Grading Criteria
• All programming assignments will need to compile and run on a Linux environment, Ubuntu 18.04 LTS. You may use other compilers or environments for developing, just make sure they compile and run on Ubuntu 18.04 LTS.
• A grade of 0 will be assigned if the program has major compiling issues
• All programming assignments must have proper documentation including block comments for each function (although smaller functions would require less documentation)
• Filenames must follow the naming convention on each assignment handout
• All code must follow K&R style or Allman Style
• Every assignment will have a 2% deduction for every hour the assignment late, if the assignment is 24 hours late, a grade of 0 will be assigned
• If you fix the problems in assignments within a week after graded and notify TAs, half of the points will be restored in order to encourage you to keep practicing

University Policies
Academic Integrity
Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at http://integrity.ou.edu/students_guide.html . To be successful in this class, all work on exams and quizzes must be yours and yours alone. You may not receive outside help. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it.

All work submitted for an individual grade, such as quizzes, should be the work of that single

individual: not their friends or tutor. Please ask me if you are in doubt before you collaborate with others. You have to work individually unless it is stated that a collaboration is allowed.

• Do not show another student a copy of your homework or individual projects before the submission deadline. The penalties for permitting your work to be copied are the same as the penalties for copying someone else work.

• If you choose to do your work on your computer, make sure that your computer account is properly protected. Use a good password, and do not give your friends access to your account or your computer system. Do not leave printouts, or thumb drives around a laboratory where others might access them.

• Upon the first documented occurrence of collaborative work, I will report the academic misconduct to the Campus Judicial Coordinator. The procedure to be followed is documented in the University of Oklahoma Academic Misconduct Code (http://integrity.ou.edu/summary_of_the_process.html). In the unlikely event that I elect to admonish the student, the appeals process is described in http://www.ou.edu/provost/integrity-rights/ .

• If you work with anyone else in completing an assignment, you must include that person's name on the submitted work. Failure to list a student you worked with on the assignment is a violation of academic integrity. If I find that the submitted work appears to be plagiarized, all students involved will be invited to my office individually to explain the work and/or perform similar work. The instructor will determine whether plagiarism occurred based on the match between the depth of understanding of the material displayed in the assignment and the individual interviews. [See http://integrity.ou.edu/faculty_guide.html]

• Programming projects may be checked by software designed to detect collaboration. This software is extremely effective and has withstood repeated reviews by the campus judicial processes.

• Tutors can be an excellent source of support for students who are having difficulty in the class, but only if the tutor is aware of the distinction between teaching students the material so that they can do their own work, and doing work for students. Tutors who do work for students are not only failing to help the students learn, they are abetting academic misconduct. Examples of misconduct include: If your tutor is sitting behind you while you are typing and methodically telling you what to enter, he or she is abetting academic misconduct. If your tutor is emailing files containing partial or complete programming projects to you, you will commit academic misconduct if you use those lines in your program. More effective use of tutoring services is to do problems that are similar to the assigned work, instead of doing assigned work. For example, it would be fine to work unassigned problems from the textbook with a tutor. This requires significant discipline, both on the part of the tutor and the part of the student. Copying from a tutor is as unacceptable as copying from another student. If your tutor doesn't know how to teach properly, please ask them to call or visit me and I will provide training and guidance. If you are tutoring someone else in the class, you can be accused of academic misconduct if this person copies your work.

• Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at http://integrity.ou.edu/students_ guide.html.

To be successful in this class, all work on exams and quizzes must be yours and yours alone. You may not receive outside help. On examinations and quizzes you will be informed about permissible study aids. Should you see someone else engaging in this behavior, I encourage you to report it to myself. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it.

• Feel free to discuss all assignments with the instructor or the TAs. However, do not discuss, look at, or copy another student's solution to a zyBooks or lab assignment. Doing so is considered cheating. For group projects, communication is expected between group members. However, communication about the solution to a project between groups is disallowed. Doing so is considered cheating.

• You may make use of the net as a reference as you are working on assignments. For projects, these references must be explicitly documented in your code. However, downloading or deriving specific solutions from the net is considered cheating.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty. [See Faculty Handbook 3.15.2 (https://apps.hr.ou.edu/FacultyHandbook#3.15.2).]

Reasonable Accommodation Policy

Students requiring academic accommodation should contact the Disability Resource Center for assistance at (405) 325-3852 or TDD: (405) 325-4173. For more information please see the Disability Resource Center website http://www.ou.edu/drc/home.html. Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities. Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

Title IX Resources and Reporting Requirement

Anyone who has been impacted by gender-based violence, including dating violence, domestic violence, stalking, harassment, and sexual assault, deserves access to resources so that they are supported personally and academically. The University of Oklahoma is committed to offering resources to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you would like to speak with someone confidentially, please contact OU Advocates (available 24/7 at 405-615-0013) or another confidential resource (see "Can I make an anonymous report?"). You may also choose to report gender-based violence and discrimination through other means, including by contacting the Institutional Equity Office (ieo@ou.edu, 405-325-3546) or police (911). Because the University of Oklahoma is committed to the safety of you and other students, I, as well as other faculty, Graduate Assistants, and Teaching Assistants, are mandatory reporters. This means that we are obligated to report gender-based violence

that has been disclosed to us to the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during Student/Office Hours. For more information, please visit the Institutional Equity Office.

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact your professor or the Accessibility and Disability Resource Center at 405/325-3852 as soon as possible. Also, see the Institutional Equity Office FAQ on Pregnant and Parenting Students' Rights for answers to commonly asked questions.

Final Exam Preparation Period

Pre-finals week will be defined as the seven calendar days before the first day of finals. Please refer to OU's Final Exam Preparation Period policy (https://apps.hr.ou.edu/FacultyHandbook#4.10).

Emergency Protocol

During an emergency, there are official university procedures that will maximize your safety.
http://www.ou.edu/emergencypreparedness/procedures

Severe Weather

If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather:

1. LOOK for severe weather refuge location maps located inside most OU buildings near the entrances

2. SEEK refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.

3. GO to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.

4. GET IN, GET DOWN, COVER UP.

5. WAIT for official notice to resume normal activities. Link to Severe Weather Preparedness - Video: https://vimeo.com/237922159

Fire Alarm/General Emergency

If you receive an OU Alert that there is a danger inside or near the building, or the fire alarm inside the building activates:

1. LEAVE the building. Do not use the elevators.
2. KNOW at least two building exits
3. ASSIST those that may need help
4. PROCEED to the emergency assembly area
5. ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due

to mobility issues.
    6. WAIT for official notice before attempting to re-enter the building.

    Link to OU Fire Safety on Campus - https://vimeo.com/125093634
Armed Subject/Campus Intruder

If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots:

    1. GET OUT: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911.

    2. HIDE OUT: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room.

    3. TAKE OUT: As a last resort fight to defend yourself.

    Link to OU Fire Safety on Campus http://www.ou.edu/emergencypreparedness/procedures/active-shooter

Tentative Schedule:
The tentative schedule is shown below.

Week 1	CS202 Review
Week 2	Asymptotic Classes (Big O, Big Θ, Big Ω)
Week 3	Sorting (Insertion sort, merge sort, quick sort)
Week 4	Threads
Week 5	Binary Trees
Week 6	Binary search trees AVL Trees
Week 7	Hashing Chaining Opening Addressing
Week 8	**Midterm**
Week 9	Perfect Hashing Cuckoo Hashing Hopscotch Hashing
Week 10	Priority Queues
Week 11	Heap sort
Week 12	Introduction to graph theory Storing a graph (Adjacency List vs Adjacency List) Graph traversals (DFS, BFS)
Week 13	Dijkstra's Minimum Weight Path (Shortest Path) Algorithm Kruskal's Minimum Weight Spanning Tree Algorithm
Week 14	Extra
Week 15	Final Exam Review
Week 16	**Final Exam**