Course Syllabus

CS 4104: Data and Algorithm Analysis

Fall 2024

1 General Course Information

CRN	83378
Meeting Time	M W F @ 10:10 AM – 11:00 AM
Classroom	NCB 250
Midterm Exam	(**Tentative**) Take-Home | Noon, October 25, 2024 (Fri) to 5:00 PM, October 28, 2024 (Mon)
Final Exam	(**Tentative**) Take-Home | Noon, December 09, 2024 (Mon) to 5:00 PM, December 13, 2024 (Fri)

Instructor: Dr. Thang Hoang

- Office Hours: Mon @ 12:00 PM – 2:00 PM
- Location: Gilbert Place, Room 4304
- Email: thanghoang@vt.edu

Teaching Assistants

	Changqi Sun	Hoang-Dung (Thomas) Nguyen
Email	changqi@vt.edu	nhd@vt.edu
Office Hours	Fri @ 9:00 AM – 11:00 AM	Tue @ 2:00 PM – 6:00 PM
Location	TBD	TBD

Course website: http://thanghoang.github.io/teaching/f24/cs4104/

Canvas: https://canvas.vt.edu

Textbook: Introduction to Algorithms (Fourth Edition). Cormen, Leiserson, Rivest, and Stein. MIT Press, 2022. ISBN: 978-0262046305.

2 Prerequisites

- CS 3114, Data Structures and Algorithms (Min Grade of C)
- MATH 3134, Applied Combinatorics and Graph Theory, or MATH 3034, Introduction to Proofs

3 Course Objectives

Data structures and algorithms from an analytical perspective. Theoretical analysis of algorithm efficiency. Comparing algorithms with respect to space and run-time requirements. Analytical methods for describing theoretical and practical bounds on performance. Constraints affecting problem solvability.

4 Grading Policy

Grading for this course will be on a 100-point scale with the following distribution:

- Homework assignments: 50%
- Midterm exam: 20%
- Final exam: 30%

Homework. There will be tentatively six assignments, each consisting of **2 to 4** problems. The homework assignment will be posted on the course website approximately one week before the due date.

All homework must be typeset with LaTeX and submitted as a single PDF to Canvas by **5:00 PM** on the due date. Any required drawings must be drawn by a digital drawing program. **Handwritten submissions will not be accepted!**

Late Submission Policy. Late submission can only be accepted if the student can present a police report or a doctor's note indicating an emergency.

No exception in deliveries: All assignment materials must be uploaded to Canvas by their corresponding deadlines. *No exception will be made, for example with claims of mistakenly uploading empty or incorrect documents, codes, etc.*

3-business day rules to raise grading mistake concerns: Any concern about potential grading mistakes must be brough up timely. Specifically, after the grades are announced, the student is responsible for pointing out the concern in 3-business days. Afterwards, the request will not be considered.

- The raised concern about grading mainly matters should it impact the final letter grade.

Task Division and Communication, Response Time for TAs: The task division between the instructor and TAs regarding grading is clarified in the first-day attendance.

- We may need 2-3 business days to reply to your inquiries. This means that if a deadline falls on Monday, we are not required to reply during the weekend. We provide more than enough time for your assignments. Leaving assignments to the last minute and rushing to TAs with questions is not an acceptable practice.
- We reserve our right not to reply if the answer to your question is in the syllabus.
- We recommend coming to office hours if your question requires detailed explanations. It is not feasible to write lengthy emails to answer such questions.

Midterm Exam. The midterm exam will be a take-home exam, distributed through the course website as a Latex document

Timeframe: Noon, October 25, 2024 (Fri) to 5:00 PM, October 28, 2024 (Mon).

Final Exam. The final exam will be a take-home exam, distributed through the course website as a LaTeX document.

Timeframe: Noon, December 09, 2024 (Mon) to 5:00 PM, December 13, 2024 (Fri).

Exam solutions must also be typeset with LaTeX and submitted as a single PDF to Canvas.

Grading Scale: A(≥93) A-(<93 - 90) B+(<90 - 87) B(<87 - 83) B-(<83 - 80) C+(<80 - 77) C(<77 - 73) C-(<73 - 70) D+(<70 - 67) D(<67 - 63) D-(<63 - 60) F(<60)

Grading will not be curved.

Grade Dissemination: Individually through Canvas.

5 Attendance

This class will be organized as the traditional **face-to-face** in **NCB 250**. There will be no online instruction. You are expected to attend the class in person. While PDF lecture notes are available on the course website, some important content (and quizzes for extra credits!) may be delivered in the classroom. Please do not request lecture recordings if you miss classes.

6 Readings

There will be reading assignment (will be posted on the course website) to be completed by class time. The reading assignment generally contains few sections or chapters in the required textbook.

7 Course Topics

Below is the list of tentative topics (subject to change) to be covered in this class.

- **Chapters 1, 2, 3, and 4**. Problems, complexity, analysis; divide and conquer; mergesort
- **Chapter 5**. Probabilistic analysis; randomized algorithms
- **Chapter 7**. Quicksort
- **Chapter 11**. Hashing
- **Chapter 14**. Dynamic programming
- **Chapter 15**. Greedy algorithms
- **Chapter 20**. Elementary graph algorithms
- **Chapter 21**. Minimum spanning trees
- **Chapter 22**. Single-source shortest path
- **Chapter 23**. All-pairs shortest path
- **Chapter 24**. Maximum flow, maximum bipartite matching
- **Chapter 34**. Encoding problems; polynomial time (P); polynomial-time verification (NP)
- **Chapter 34**. NP-completeness and reducibility
- **Chapter 34.** NP-completeness proofs
- **Chapter 34**. NP-complete problems

- **Chapter 29***. Linear programming
- **Chapter 30***. Polynomial and the FFT

*Chapters 29, 30 will be covered if time permits.

8 Academic Accommodations

If the student anticipates or experiences academic barriers that may be due to disability, including but not limited to ADHD, chronic or temporary medical conditions, deaf or hard of hearing, learning disability, mental health, or vision impairment, please contact the Services for Students with Disabilities (SSD) office (540-231-3788, ssd@vt.edu, or visit https://ssd.vt.edu).

If the student has an SSD accommodation letter, please meet with the instructor privately during office hours as early in the semester as possible to deliver the letter and discuss accommodations. The student must give the instructor reasonable notice to implement the accommodations, which is generally 5 business days and 10 business days for final exams.

9 Academic Integrity

The Honor Code applies. All work submitted must be the student's own work. Students may solicit help only from the instructor or the teaching assistant. The Undergraduate Honor Code pledge that each member of the university community agrees to abide by states:

"*As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do.*"

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. See additional information about the Honor Code here.

All the lecture notes, assignments, quizzes, tests, exams, solutions, and other materials distributed to or generated in this class are intended for use only by students enrolled in this CRN (section) this semester. Without the instructor's written permission, no one may show, give, or otherwise make such class materials available to anyone not enrolled in this CRN this semester. Prohibited activities include, but are not limited to, uploading a test, uploading solutions to problems, and submitting such class materials for online posting. The prohibition on sharing solutions applies to all solutions, regardless of who wrote the solutions.

10 Standard University Policies and Student Expectations

Attendance Policy: Students are expected to attend classes. **There will be in-class quizzes from time to time**, and there will not be a make-up for them.

Communication: Every enrolled VT student receives an official VT email account that ends with "vt.edu". All official VT correspondence to students is sent to that account. You are expected to regularly check email directed to your official VT email addresses for any announcements. Use your VT email account to send emails or the Canvas messaging system. Emails sent to the instructor from another email address may be filtered as spam and be ignored. Make sure your email always references the course name or number. **In all communications (email, discussion board), be polite and respectful to your interlocutor at all times, regardless of their rank; e.g. student, TA, instructor, staff**…

End of Semester Student Evaluations: All classes at VT make use of an online system called SPOT for students to provide feedback to the University regarding the course. These surveys will be made available at the end of the semester, and the University will notify you by email when the response window opens. Your participation is highly encouraged and valued.

11 Important Notes

Follow the syllabus, announcement, and https://www.registrar.vt.edu/dates-deadlines/academic-calendar.html

Right to Modify the Syllabus: The instructor reserves the right to modify the course syllabus at any time during the course to address changes needed in content, course outline, exam dates, etc.

**Every part of this syllabus is subject to adjustment as the semester progresses.*