CS-4104 (CRN 13405 and CRN 21269)
Data and Algorithm Analysis
Spring 2023

Essential information.

Instructor	Dr. Adrian Sandu
• Phone	231-2193
• E-mail	sandu@cs.vt.edu
• Office	2222 KnowledgeWorks II
• Office hours	By appointment
Teaching Assistants	GTA: Xiao Liang (xliangvt@vt.edu) UTA: Antonio Lopez Segura (antoniols@vt.edu) GTA: Mehdi Esmaili (mesmaili@vt.edu) UTA: Jack Homer (jhomer19@vt.edu) GTA: Keyuan Zhang (keyuanz@vt.edu) UTA: Shashank Datta Bezgam (shashankdatta@vt.edu)
• Office hours	In person, McBryde Hall 106 Mondays: 10am-11am (Mehdi) Tuesdays: 10am-11am (Keyuan), 2pm-3pm (Antonio), 3pm-5pm (Xiao) Wednesdays: 10am-11am (Mehdi) Thursdays: 10am-11am (Xiao), 11am-12pm (Shashank), 2pm-3pm (Antonio) Fridays: 10am-11am (Keyuan), 4pm-5pm (Jack)
• Office hours	via Zoom Mon: 6:00-7:00pm (`https://virginiatech.zoom.us/j/83982974842`, ID: 839 8297 4842) Tue,Thu,Fri: 5:00–6:00pm (`https://virginiatech.zoom.us/j/83875396709`, ID: 838 7539 6709)
Lecture (CRN 13405)	MW 2:30PM–3:45PM. Lavery Hall - WLH 350.
Final exam (CRN 13405)	Section 14M: May 10, 2023, 10:05AM–12:05PM
Lecture (CRN 21269)	MW 4:00PM–5:15PM. Classroom Building - NCB 270.
Final exam (CRN 21269)	Section 16M: May 8, 2023, 7:45AM–9:45AM
Prerequisites	(CS 2604 or CS 2606), CS 3114, (MATH 3134 or MATH 3034)

Textbook.

- "Algorithm Design" by Jon Kleinberg and Eva Tardos. Addison-Wesley, 2006, ISBN 0-321-29535-8.
- Slides accompanying textbook: `https://www.cs.princeton.edu/~wayne/kleinberg-tardos`.

Additional reference.

- "Introduction to Algorithms", Third Edition, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. MIT Press, ISBN 9780262033848.

About the Course.

This course emphasizes the understanding of data structures and algorithms from an analytical perspective rather than from an implementation standpoint. The concepts developed allow discussion of the efficiency of an algorithm and the comparison of two or more algorithms with respect to space and run-time requirements. Analytical methods are used to describe theoretical bounds as well as practical ones. In general, this course discusses paradigms for algorithm design, addresses the constraints that affect problem solvability, and defines the theory of NP-completeness as a means to understand intractable problems.

Grading.

Homework will be assigned every one to two weeks. There will be a midterm exam and a comprehensive final exam. The grade will be based on:

20% Midterm Exam (in person)

30% Final Exam (in person)

50% Homework (lowest homework score will be dropped)

Key points:

- Each homework will consist of multiple problems; you will have about one week between when the homework is posted and the deadline for submitting the solutions. The Midterm and Final exams will consist of multiple problems and will have their own deadlines.
- The homework and exams will be posted on the class web page. Students will submit their solutions through Canvas. The solutions need to be typeset (LaTeX is suggested); handwritten solutions will not be graded.
- Solutions submitted after the corresponding deadline will not be graded, except in those situations where you have obtained prior approval from the instructor. However, we will drop from the lowest homework score when computing your homework grade. Expect some homework problems to be difficult and to require creative solutions; please start working on the homework early, and take advantage of the office hours that the TAs hold.
- If you feel that your solutions have been graded incorrectly you may request a re-evaluation within one week of the date you received the graded assignment back.

Syllabus.

Below is the schedule for the course, which may be adjusted as needed during the semester. Students are expected to supplement lectures with a careful study of the relevant sections of the textbook.

- Introduction and Stable Matching. Chapter 1.
- Basic Algorithm Analysis. Chapter 2.
- Graphs. Chapter 3.
- Greedy Algorithms. Chapter 4.

- Divide and Conquer. Chapter 5.
- Dynamic Programming. Chapter 6.
- Network Flow. Chapter 7.
- NP and Computational Intractability. Chapter 8.
- Coping with intractability. Chapter 10.
- Approximation algorithms. Chapter 11.

Reading.

There will be reading assignments consisting of sections from the textbook. Reading assignments will be announced on the class web page and you are strongly encouraged to complete them by class time.

Disclaimer.

The information given to you during class may supersede the information in this syllabus or on the web page.

Honor Code.

Students are expected to fully comply to the spirit and the letter of the Honor Code: `www.honorsystem.vt.edu`.

- You are expected to work on your own on solving the exams. You cannot consult with anyone, and you cannot copy answers from third party sources.
- You are allowed to work/brainstorm in pairs – with another student enrolled in class – for solving homework problems. However, you must write down the final solutions independently. If you do choose to work with a partner on a given homework please provide his/her name together with your submitted solutions.

If you have any problems, the first step is to discuss with me directly.

Special Arrangements.

Please let me know if you have a situation that requires special arrangements, or emergency medical information to share with the instructor. If you have an unexpected emergency, e.g., due to medical or family reasons, and cannot turn in homework or exam solutions in time, please let me know asap, before the respective deadline.