CSE 6140/ CX 4140

Computational Science and Engineering

ALGORITHMS

Introduction

Instructor: Xiuwei Zhang

Assistant Professor

School of Computational Science and Engineering

- Computational Science & Engineering (CSE) Algorithms
- Computational Modeling Algorithms (CX 4140)

"Algorithm"

named after mathematician
Muhammad ibn Musa **al-Khwarizmi** (780-850)
algoritmi
algorismus
algorism
algorithm

CSE 6140/CX 4140

- Designing algorithms for computational science & engineering applications:
  - Algorithm design
  - Proofs of correctness
  - Complexity analysis
  - Experimentation
  - Optimization

CSE 6140/CX 4140

Georgia
Tech

- Background/Prerequisites:
  - Type in exam solutions - Latex, Word…
    - for homework, hand-written submissions get 5% penalty
  - Data structures and elementary algorithms such as Breadth First Search
  - Familiarity with writing formal proofs
  - Programming in one of C/Python
    - Used in final project and programming assignment

Wide Range of Applications of Algorithms

- Data analysis
  - Clustering
- Databases
  - Queries
- Social Network Analysis
  - Centrality measures, recommendation
- Circuit Design
  - Every electronic device you use
- Scheduling & Resource Allocation
  - Timetabling (your classes and exams)
- Transportation / computer networks
  - Routing, network design
- Computational biology
  - Genome sequence alignment, protein folding
- Computational physics & chemistry
- …

Algorithmic Paradigms

- Greedy
- Divide-and-conquer
- Dynamic programming
- Intractability: no known polynomial time algorithm
- Coping with intractability: intelligent search, approximation & heuristics
- Network flow

- Develop critical thinking, problem-solving & rigorous analysis skills, as well as skills in implementation and empirical analysis of algorithms

Registration

- This course includes three sections
    - CX 4140 (Undergraduates)
    - CSE 6140A (Graduate Students)
    - CSE 6140Q (Distance Learning)

- Waitlists
    - Oversubscribed
    - Please remove yourself from the waitlist if class not needed
    - Email Nirvana Edwards <cse-advisor@cc.gatech.edu> ONLY IF you are
        - PhD student in CSE
        - MS student that needs this course to graduate THIS FALL
        - Give your GTid and reason

Course Staff

- Instructor: Xiuwei Zhang xiuwei.zhang@gatech.edu, https://bluejeans.com/6419938749

- Teaching Assistants

Shahrokh Shahi (head TA), shahi@gatech.edu
https://bluejeans.com/2495661695

Ziqi Zhang, ziqi.zhang@gatech.edu
https://gatech.bluejeans.com/3043590670

Benjamin Cobb bcobb33@gatech.edu
https://bluejeans.com/6531281486

Jiancong Gao, jgao320@gatech.edu
https://bluejeans.com/1244041450/

Chenjun Tang
ctang90@gatech.edu
https://bluejeans.com/4197069985/

Office Hour

TA office hours start from the week of 8/24

	Monday	Tuesday	Wednesday	Thursday	Friday
9 AM					
10 AM		Ziqi 10am, https://gatech.bluejeans.com/30435906			
11 AM				Ben 11am, https://bluejeans.com/6531281486	
12 PM					
1 PM					Ziqi 1pm, https://gatech.bluejeans.com/304359067
2 PM	Instructor 2pm, https://bluejeans.com/6419938749		Instructor 2pm, https://bluejeans.com/6419938749	Jiancong 2pm, https://bluejeans.com/1244041450/	
3 PM	Shahrokh 3pm, https://bluejeans.com/2495661695	Shahrokh 3pm, https://bluejeans.com/2495661695			Ben 3pm, https://bluejeans.com/6531281486
4 PM			Jiancong 4pm, https://bluejeans.com/1244041450/	Chenjun 4pm, https://bluejeans.com/4197069985/	Chenjun 4pm, https://bluejeans.com/4197069985/
5 PM					
6 PM					

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11 AM			First week only OH	Ben 11am, https://bluejeans.com/6531281486	
12 PM					
1 PM					Ziqi 1pm, https://gatech.bluejeans.com/304359067
2 PM	Instructor 2pm, https://bluejeans.com/6419938749		Instructor 2pm, https://bluejeans.com/6419938749	Jiancong 2pm, https://bluejeans.com/1244041450/	
3 PM	Shahrokh 3pm, https://bluejeans.com/2495661695	Shahrokh 3pm, https://bluejeans.com/2495661695			Ben 3pm, https://bluejeans.com/6531281486
4 PM			Jiancong 4pm, https://bluejeans.com/1244041450/	Chenjun 4pm, https://bluejeans.com/4197069985/	Chenjun 4pm, https://bluejeans.com/4197069985/
5 PM					
6 PM					

First week OH by instructor: Wed. 11-12, https://bluejeans.com/6419938749

Course Schedule/Important Dates

- Teaching Schedule:
  will be posted on Canvas for the upcoming ~2 weeks

- Important Dates:

  - Aug 17: Start of semester

  - Aug 21: Drop deadline without W

  - Sep 16 (Wed): Test 1

  - Oct 21 (Wed): Test 2

  - Dec 2 (Wed): Test 3

  - Oct 24: Withdrawal deadline to change grade mode from letter grade to pass/fail (and vice verse), or drop with a W

  - Dec 4: Project due

Course Details

- Canvas:
  - Syllabus
  - Course schedule
  - Lecture videos
  - Slides
  - Assignments
  - Emails
  - Grades

Textbooks in Bookstore, Library, eBook:
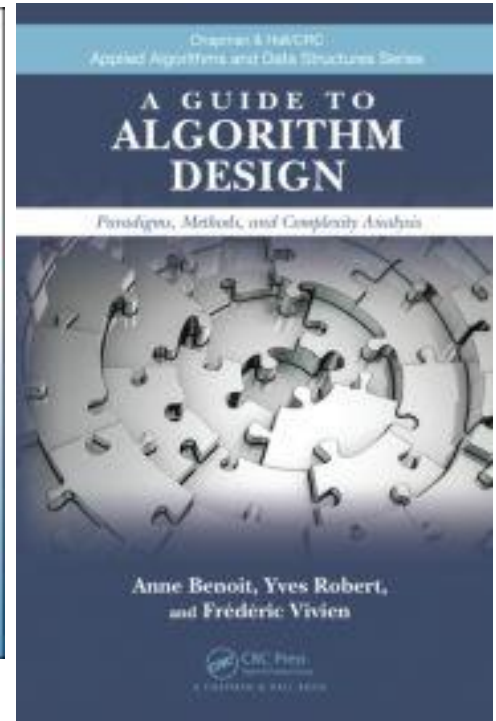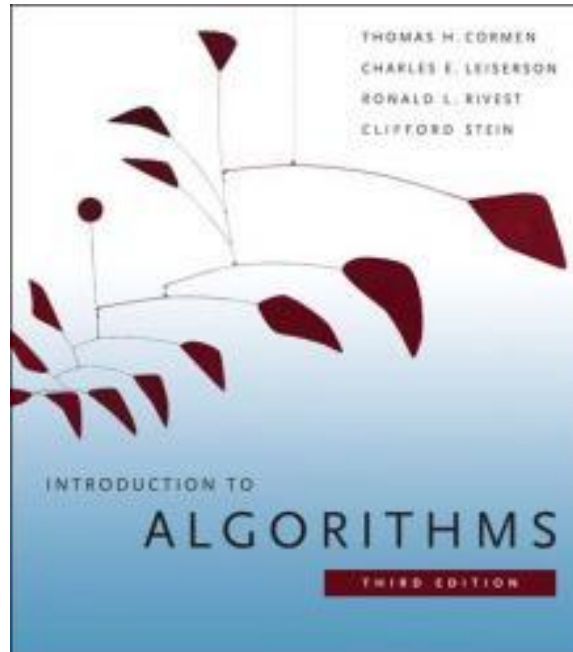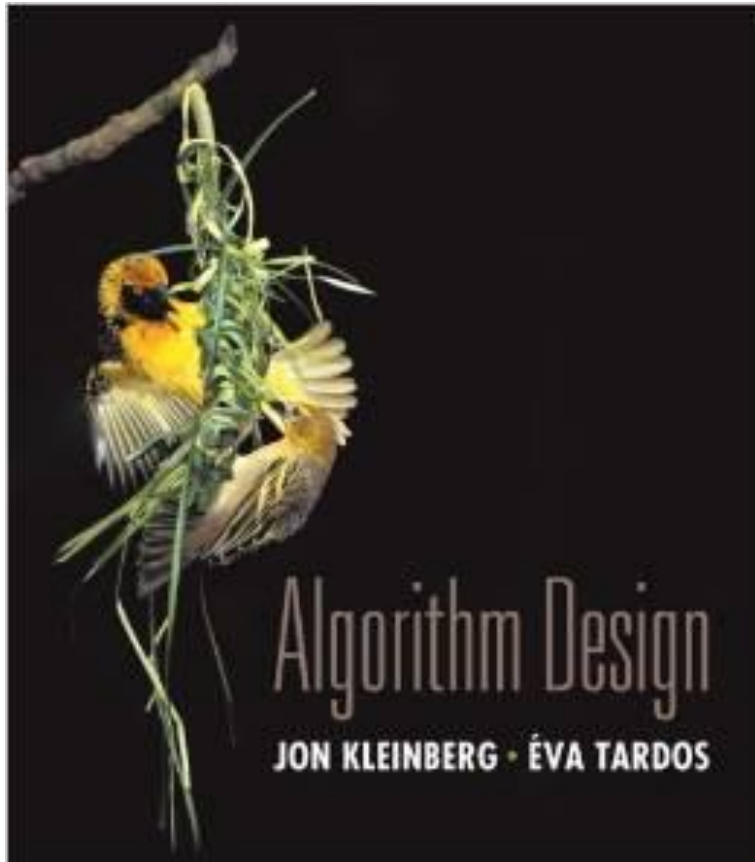
Reading list after each class

Course Grading

- ## 25% Homework (4)
  - Proofs & implementation; Hand-written answers lead to 5% penalty.

- ## 15% Test 1
- ## 20% Test 2
- ## 20% Test 3
- ## 20% Project
- Tests are closed-book and timed, proctored through Honorlock. There is a 15-hour time window (9am-11:59pm) on the test day.
- In very special cases, if you really have to miss a deadline or an exam (!), talk to the instructor as early as possible.

Homework policy

- Collaboration
    - Can form study group of up to 3 students
    - Study group must work on each problem jointly
    - Each student must write up solutions individually
    - Must acknowledge all collaborators

- Course materials are always permitted
- No external resources, e.g., Google
- You are encouraged to attend office hours as needed

- Grace period:
    - All homework deadlines are on Fridays. We give a grace period of 48 hours. Avoid last-minute submission.

Where To Get Help

- Textbooks
  - "Algorithm Design" by Kleinberg and Tardos
  - Other recommended books

- Piazza
  - Link through canvas
  - By students for students
  - Mindful of **not revealing homework answers** on piazza

- Office hours
  - Every day of the week

Background Evaluation Quiz

- Can be found from the Assignments module on Canvas

- Scores not considered for the final grade of the course; Helps students decide whether to take this course

- Typed answers preferred; scanned copies are accepted - please make sure your answers can be clearly read.

- The quiz is timed and has a duration of 60min.

- In order for your answers to be graded, you must submit your answers as a .pdf file, through Canvas, by **6pm Tuesday Aug. 18th.**

- Grades will be released on Canvas by Thursday 6pm.