CSE 431/531: Algorithm Analysis and Design (Fall 2022)

Course Information

Time: TuTh 5:00pm - 6:20pm

Location: Cooke 121

Credits: 3

Please sign up for the course on Piazza.

Instructor

Shi Li

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Overview

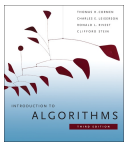
Algorithm design and analysis is fundamental to all areas of computer science and gives a rigorous framework for the study of optimization. This course provides an introduction to algorithm design through a survey of the common algorithm design paradigms of greedy optimization, divide and conquer, dynamic programming, and linear programming, and the NP-completeness theory.

Textbook

There is no required text book for the class, but it is recommended that you have one of the following books:

- Jon Kleinberg and Eva Tardos *Algorithm Design.* 1st Edition, 2005, Pearson.

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein *Introduction To Algorithms* 3rd Edition, 2009, MIT Press.



Grading

Your final grade will be computed as follows:

- Participation: 10%. Quizzes will be given randomly during the lectures.
- Theory Homeworks: 40% = 8% × 5. We choose the best 5 scores out of 6 theory homeworks.
- Programming Assignments: 20% = 10% × (2 programming assignments).
- Final Exam: 30%.

Policies

- **Late policy** You have one late credit. If you use the credit, you can submit a theory or programming homework 3 days late. No other late submissions will be accepted.
- **Collaboration policy** For homework problems, you are allowed to discuss with classmates. However, it is highly recommended that you first think about each problem for enough time before the discussion. You must write your solutions by yourself, in your own words. You need to write down the names of the students you collaborated with. For the programming problems, you must implement the algorithms by yourself.
- **You can not copy codes, homework and exam problem solutions from other students and external resources. Per departmental policy of academic integrity violations, if we determined that you committed an academic integrity violation, you will get an "F" for the course, and the case will be reported to the department and the university and recorded in their databases.**

Slides

NA stands for "no animation".

- Introduction, Introduction-NA (last updated: 09/09/22 15:09)
- GraphBasics, GraphBasics-NA (last updated: 09/08/22 15:36)
- Greedy, Greedy-NA (last updated: 08/26/22 05:45) Greedy Exercise Problems
- DivideAndConquer, DivideAndConquer-NA (last updated: 10/13/22 16:41) Divide and Conquer Exercise Problems
- DynamicProgramming, DynamicProgramming-NA (last updated: 11/01/22 16:39) Dynamic Programming Exercise Problems
- GraphAlgorithms, GraphAlgorithms-NA (last updated: 08/26/22 05:45)
- NPC, NPC-NA (last updated: 11/30/22 22:28)

Deadlines for Homeworks and Projects

HWs/Projects	Releasing Date	Deadline
HW1	Sep 13	Sep 25
HW2	Sep 29	Oct 11
HW3	Oct 13	Oct 23
HW4	Nov 1	Nov 13
HW5	Nov 17	Nov 27
HW6	Dec 6	None
Project 1	Oct 13	Nov 20
Project 2	Nov 17	Dec 11

Syllabus & Tentative Schedule

Week	Date	Topic	Contents	Other Notes
1	Aug 30	Introduction	syllabus	
	Sep 1		asymptotic notations (KT 2.2)	
2	Sep 6		common running times (KT 2.4)	
	Sep 8	Graph Basics	graph basics, connectivity and traversal (KT 3.1, 3.2, 3.4)	
3	Sep 13		topological order (KT 3.6)	HW1 Released
	Sep 15	Greedy Algorithms	basics, interval scheduling (KT 4.1)	
4	Sep 20		interval scheduling continued, optimum caching (KT 4.3)	
	Sep 22		optimum caching continued	Sep 25: HW1 Deadline
5	Sep 27		Huffman code (KT 4.8)	
	Sep 29		Huffman code continued, exercise problems	HW2 Released

6	Oct 4	Divide and Conquer	merge sort and counting inversions (KT 5.1, 5.3)	
	Oct 6		quicksort, median-finder, selection (KT 13.5)	
7	Oct 11		polynomial and matrix multiplications (KT 5.5)	HW2 Deadline
	Oct 13		solving recurrences (KT 5.2)	HW3 Released Proj1 Released
8	Oct 18	Dynamic Programming	weighted interval scheduling (KT 6.1)	
	Oct 20		subset sums and knapsack (KT 6.4)	Oct 23: HW3 Deadline
9	Oct 25		Sequence Alignment (KT 6.6)	
	Oct 27		Matrix-Chain-Multiplication, Optimum Binary Search Tree	
10	Nov 1		Exercise Problems	HW4 Released
	Nov 3	Graph Algorithms	Kruskal's algorithm for MST (KT 4.5)	
11	Nov 8		Prim's algorithm for MST (KT 4.6)	
	Nov 10		Dijkstra's algorithm for shortest path (KT 4.4)	Nov 13: HW4 Deadline
12	Nov 15		shortest path with negative weights and Bellman-Ford, Floyd-Warshall (KT 6.8)	
	Nov 17	NP-Completeness	P, NP, Co-NP, KT 8.1-8.3)	HW5, Proj2 Released Nov 20: Proj1 Deadline
13	Nov 22		P=NP?, NPC (KT 8.4)	
	Nov 24		Fall Recess	Nov 27: HW5 Deadline
14	Nov 29		circuit-SAT, 3-SAT (KT 8.5)	
	Dec 1		independent set (KT 8.5)	

15	Dec 6	HW Solutions, Final Review, Q&A	HW6 Released
	Dec 8		Dec 11: Proj2 Deadline
Dec 16, Fri, 11:45am-2:45pm: Final Exam, at Knox 20			