CS249 Algorithms and Analysis (Online)

Instructor Information	Professor An Email: dranteaching@hotmail.com		
Term	June 27, 2022 - July 22, 2022	**Credits**	4 units
Course Delivery	The class will be delivered in the format of online. Other than recorded lecture videos, the instructor will arrange 2 hours' real-time interactions with students per week (via discussion forum, zoom meeting, and WeChat). The workload students are expected to complete to properly pass this course is about 15 hours per week.		
Required Texts (with ISBN)	Recommended Texts: T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, 2009, Introduction to Algorithms, 3rd edition, The MIT Press. ISBN: 978-0-262-03384-8. E. Horowitz, S. Sahni and S. Rajasekaran, 1998, Computer Algorithms, Computer Science Press. ISBN: 0-7167-8316-9.		
Prerequisite	Students are expected to have a good knowledge of basic data structures and algorithms.		

Course Overview

Introduction to advanced data structures and algorithms in computer science including key algorithmic design paradigms such as divide and conquer, greedy, dynamic programming. Topics include balanced search trees, heaps, efficient algorithms for sorting, searching and graph problems.

Learning Outcomes

A student who satisfactorily completes this course should be able to accomplish the following:

1. Find and prove runtime bounds for iterative and recursive algorithms;
2. Design efficient algorithms to solve computational problems;
3. Understand and employ algorithmic design paradigms including divide and conquer, dynamic programming, and greedy algorithms in solving varied computational problems;
4. Implement complex algorithms and data structures with a modern high level programming language.

Grading Policy

Part	Percentage
Quizzes	10%
Assignments	50%
Midterm	20%
Final Exam	20%
Course Total	100%

Grading Scale is as follows

Number grade	Letter grade	GPA
90-100	A	4
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2
62-64	C-	1.7
60-61	D	1
≤59	F (Failure)	0

Class Schedule

Date	Lecture	Readings	Online Teaching Arrangement
Day 1	Definition of Algorithm, Pseudocode Conventions, Recursive Algorithms, Insertion Sort, Correctness	CLRS: 1.1, 1.2, 2.1-2.3 HSR: 1.2	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 2	Time and Space Complexities, Common Functions, Mathematical Preliminaries	CLRS: 3.1, 3.2 HSR: 1.3	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 3	Divide and Conquer - Merge Sort	CLRS: 2.3 HSR 3.4	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 4	Divide and Conquer – Quicksort	CLRS: 7.1 HSR 3.5	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 5	Quicksort Analysis, Randomized Quicksort	CLRS: 7.2-7.3 HSR: 3.5	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 6	Heaps	CLRS: 6.1-6.3 HSR: 2.4.1	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 7	Heapsort	CLRS: 6.4 HSR: 2.4.2	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 8	Lower Bounds for Sorting	CLRS: 8.1	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 9	Counting Sort, Radix Sort	CLRS: 8.2, 8.3	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 10	Midterm Exam		

Day 11	Binary Search, Binary Search Trees	CLRS: 12.3 HSR:2.3.1	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 12	AVL Trees	CLRS: 12.3 HSR:2.3.1	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 13	Hashing	CLRS: 11	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 14	Graphs and Search of Graphs, DFS, BFS	CLRS: 22.1-22.3 HSR: 6.2.1-6.2.2	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 15	Greedy Algorithms - Minimum Spanning Trees	CLRS: 23.2 HSR: 4.5.1-4.5.2	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 16	Dynamic Programming – Single Source Shortest Paths	CLRS: 24.3 HSR: 5.1, 5.4	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 17	Dynamic Programming & Backtracking – Knapsack Problem	HSR: 7.6	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 18	Greedy algorithms – Huffman Codes	CLRS: 16.3	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 19	Approximation Algorithms, Local Search, Travelling Salesman Problem Dynamic Programming – All Pairs Shortest Paths	CLRS 25.2, 35.2 HSR: 5.3	approximately 50 minutes pre-recorded video lectures plus 50 minutes online interaction via Zoom
Day 20	Final Exam		