上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

Shanghai Jiao Tong University

CS249 Algorithms and Analysis (Online)

Instructor Information	Xiangdong An Home Institution: UT Martin Email: dranteaching@hotmail.com		
Term	December 17, 2020 – January 8, 2021	**Credits**	4 units
Course Delivery	The class will be delivered in the format of online. Other than recorded lecture videos, the instructor will arrange 4 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 10-15 hours per week. Exams are closed-book and proctored under zoom-meeting camera.		
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
Day 1	Definition of Algorithm, Pseudocode Conventions, Recursive Algorithms, Insertion Sort, Correctness	CLRS: 1.1, 1.2, 2.1-2.3 HSR: 1.2
Day 2	Time and Space Complexities, Common Functions, Mathematical Preliminaries	CLRS: 3.1, 3.2 HSR: 1.3
Day 3	Divide and Conquer - Merge Sort	CLRS: 2.3 HSR 3.4
Day 4	Divide and Conquer – Quicksort	CLRS: 7.1 HSR 3.5
Day 5	Quicksort Analysis, Randomized Quicksort	CLRS: 7.2-7.3 HSR: 3.5
Day 6	Heaps and Heapsort	CLRS: 6.1-6.4 HSR: 2.4.1-2.4.2
Day 7	Lower Bounds for Sorting	CLRS: 8.1
Day 8	Counting Sort, Radix Sort	CLRS: 8.2, 8.3
Day 9	Midterm Exam	
Day 10	Binary Search, Binary Search Trees	CLRS: 12.3 HSR:2.3.1
Day 11	AVL Trees, Hashing	CLRS: 11, 12.3 HSR:2.3.1
Day 12	Graphs and Search of Graphs, DFS, BFS	CLRS: 22.1-22.3 HSR: 6.2.1-6.2. 2
Day 13	Greedy Algorithms - Minimum Spanning Trees	CLRS: 23.2 HSR: 4.5.1-4.5.2
Day 14	Dynamic Programming – Single Source Shortest Paths	CLRS: 24.3 HSR: 5.1, 5.4
Day 15	Dynamic Programming & Backtracking – Knapsack Problem	HSR: 7.6
Day 16	Greedy algorithms – Huffman Codes	CLRS: 16.3
Day 17	Approximation Algorithms, Local Search, Travelling Salesman Problem Dynamic Programming – All Pairs Shortest Paths	CLRS 25.2, 35.2 HSR: 5.3
Day 18	Final Exam	