上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

Shanghai Jiao Tong University

CS249 Algorithms and Analysis

Instructor Information:	Xiangdong An Home Institution: University of Tennessee at Martin Email: xan@utm.edu Office Hours: Determined by Instructor		
Term:	December 16, 2019 - January 7, 2020	**Credits:**	4 units
Class Hours:	Monday through Friday, 160 mins per teaching day		
Discussion Sessions:	2 hours each week, conducted by teaching assistant(s)		
Total Contact Hours:	64 contact hours (1 contact hour = 45 mins, 2880 mins in total)		
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:	Software Architecture: Design and Implementation or Advanced Programming or Advanced Programming Techniques or Introduction to Algorithms		

Learning Outcomes

Compare, contrast, and apply the key algorithmic design paradigms: divide and conquer, greedy, dynamic programming, and randomized algorithms; Compare, contrast, and apply key data structures: trees, lists, stacks, queues, hash tables, heaps, and graph representations; Define, compare, analyze, and solve general algorithmic problem types: sorting, searching, graphs; Prove the correctness and analyze and determine time complexity of algorithms; Implement, empirically compare, and apply fundamental algorithms and data structures to real-world problems.

Enabling Knowledge: You will gain skills as you apply knowledge effectively in diverse contexts with creativity and initiative. In doing so, you will: Demonstrate mastery of a body of knowledge that includes recent developments in computer science and information technology; Recognize and use research principles and methods applicable to computer science and information technology.

Critical Analysis: You will learn to accurately and objectively examine and consider computer science and information technology (IT) topics, evidence, or situations, in particular to: (i) Analyze and model requirements and constraints for the purpose of designing and implementing software artefacts and IT systems; (ii) Evaluate and compare designs of software artefacts and IT systems on the basis of organizational and user requirements.

Problem Solving: Your capability to analyze problems and synthesize suitable solutions will be extended as you learn to: Design and implement software solutions that accommodate specified requirements and constraints, based on analysis or modelling or requirements specification.

Communication: You will learn to communicate effectively with a variety of audiences through a range of modes and media, in particular to: Present a clear, coherent and independent exposition of software applications, alternative IT solutions, and decision recommendations to both IT and non-IT personnel via technical reports of professional standard and technical presentations. Interpret abstract theoretical propositions, choose methodologies, justify conclusions and defend professional decisions to both IT and non-IT personnel via technical reports of professional standard and technical presentations.

Team Work: You will learn to work as an effective and productive team member in a range of professional and social situations, in particular to: Work effectively in different roles, to form, manage, and successfully produce outcomes from teams whose members may have diverse cultural backgrounds and life circumstances and differing levels of technical expertise.

Grading Policy

Part	Percentage
Attendance	10%
Assignments	40%
Midterm	20%
Final Exam	30%
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	Content	Readings
Day 1	Definition of Algorithm, Pseudocode Conventions, Recursive Algorithms, Insertion Sort, Correctness	CLRS: 2.1, 2.2 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, Quicksort Analysis, Randomized Quicksort	CLRS: 7.1-7.3 HSR: 3.5
Day 5	Heaps and Heapsort	CLRS: 6.1-6.4 HSR: 2.4.1-2.4.2
Day 6	Lower Bounds for Sorting, Radix Sort	CLRS: 8.1, 8.3
Day 7	Midterm Exam	
Day 8	Approximation Algorithms, Local Search, Travelling Salesman Problem	CLRS: 35.2
Day 9	Binary Search, Binary Search Trees and AVL Trees	CLRS: 12.3 HSR: 2.3.1
Day 10	Graphs and Search of Graphs, DFS, BFS	CLRS: 22.1-22.3 HSR: 6.2.1-6.2. 2
Day 11	Greedy Algorithms - Minimum Spanning Trees	CLRS: 23.2 HSR: 4.5.1-4.5.2
Day 12	Dynamic Programming – Single Source Shortest Paths	CLRS: 24.3 HSR: 5.1, 5.4
Day 13	Dynamic Programming – All Pairs Shortest Paths	CLRS 25.2 HSR: 5.3
Day 14	Greedy algorithms – Huffman Codes	CLRS: 16.3
Day 15	Final Exam	