上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

Shanghai Jiao Tong University

CS249 Algorithms and Analysis

Instructor Information:	TBD		
Term:	December 16, 2019 - January 7, 2020	**Credits:**	4 units
Class Hours:	Monday through Friday, 160 mins per teaching day		
Discussion Sessions:	2.6 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 (i) E. Horowitz, S. Sahni and S. Rajasekaran, 1999, Computer Algorithms, Galgotia, New Delhi. Reference Books: (i) G. Brassard and P. Bratley, 1997, Fund amentals of Algorithms, PHI, New Delhi. (ii) A.V. Aho, J.E. Hopcroft, J.D. Ullmann, 1974, The design and analysis of Computer Algorithms, Addison Wesley, Boston. (iii) S.E.Goodman and S.T.Hedetniemi, 1977, Introduction to the Design and Analysis of algorithms, Tata McGraw Hill Int. Edn, New Delhi		
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: brute force, divide and conquer, decrease and conquer, transform and conquer, greedy, dynamic programming and iterative improvement;

Compare, contrast, and apply key data structures: trees, lists, stacks, queues, hash tables and graph representations;

Define, compare, analyse, and solve general algorithmic problem types: sorting, searching, graphs and geometric;

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.

Enabling Knowledge: You will gain skills as you apply knowledge with creativity and initiative to new situations. In doing so, you will: Demonstrate mastery of a body of knowledge that includes recent developments in computer science and information technology; Recognise 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) Analyse 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 organisational and user requirements.

Problem Solving: Your capability to analyse problems and synthesise 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	Points
Attendance	5%	5
Assignment	15%	15
Problem sets	30%	30
Exams	50%	50
Course Total	100%	100 Points

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

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Class Schedule

Date	Content	Readings
Day 1	Introduction: Definition of Algorithm pseudocode conventions recursive algorithms	Reference books Recommended reading
Day 2	Problem sets	Reference books Recommended reading
Day 3	Time and space complexity-practical complexities-randomized algorithms- repeated element-primality testing-divide and conquer: general method-finding maximum and minimum-merge sort	Reference books Recommended reading
Day 4	Divide and conquer contd.- Quicksort, Selection, Srassen's matrix multiplication-greedy	Reference books Recommended reading
Day 5	Problem sets	Reference books Recommended reading
Day 6	Problem sets	Reference books Recommended reading
Day 7	Method: general method- knapsack problem- tree vertex splitting – job sequencing with deadlines-optimal storage on tapes	Reference books Recommended reading
Day 8	String editing- search techniques for graphs- DFS-BFS- connected components-biconnected components	Reference books Recommended reading
Day 9	Problem sets	Reference books Recommended reading
Day 10	Problem sets	Reference books Recommended reading
Day 11	Back tracking: general method- sum of subsets-graph coloring-Hamiltonian cycles	Reference books Recommended reading
Day 12	Branch and bound: general method- travelling sales person problem	Reference books Recommended reading
Day 13	Lower Bound Theory	Reference books Recommended reading
Day 14	Problem sets	Exam Preparation
Day 15	Final Exam	