SELECTED TOPICS IN ALGORITHMS

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PRE-REQUISITES : Knowledge of basic algorithms

INTENDED AUDIENCE : Under-graduate and post-graduates

INDUSTRY SUPPORT : All software companies especially google,microsoft,etc.

COURSE OUTLINE :

Every application area of computer science and engineering demands efficient design of algorithms. Indeed an efficient algorithm for a problem may take much less time even on a old computer than an inefficient algorithm for the same problem running on the fastest computer on the earth. In basic data structure and algorithm course, we learn elementary techniques like greedy algorithms, divide and conquer, dynamic programming, etc. In this course, we will learn more advanced algorithm design techniques.

ABOUT INSTRUCTOR :

Prof. Palash Dey is an Assistant Professor in the Department of Computer Science and Engineering at Indian Institute of Technology, Kharagpur since 2018. Before joining IIT Kharagpur, he was a post-doctoral INSPIRE faculty in TIFR, Mumbai for one year. He finished his Ph.D. and M.E. from the Department of Computer Science and Automation at Indian Institute of Science, Bangalore in 2017 and 2013 respectively. Prior to that, he finished his B.E. from the Department of Computer Science and Engineering at Jadavpur University in 2010. His primary field of research is algorithmic game theory. He is broadly interested in theoretical computer science.

COURSE PLAN :

Week 1: Network Flows, Ford-Fulkerson Algorithm, Edmond-Karp Algorithm
Week 2: Max-Flow Min-Cut Theorem, Application of Network Flows, Edmond's Matching Algorithm
Week 3: Randomization as Algorithm Design Technique, Karger's Min Cut Algorithm, Randomized Algorithm for 2-SAT
Week 4: Polynomial Identity Testing, Schwartz-Zippel Lemma Application of PIT: Perfect Bipartite Matching
Week 5: Elementary Concentration Inequalities: Markov, Chebyshev, Chernoff-Hoeffding
Week 6: Markov Chain, Random Walks, Monte Carlo Method, DNF Counting
Week 7: NP-Completeness
Week 8: Approximation Algorithm: Vertex Cover, Set Cover, Travelling Salesman Problem APTAS for Bin Packing
Week 9: FPTAS for Knapsack, Linear Programming Basics
Week 10: Designing Approximation Algorithms using Linear Programs: Rounding, Primal-Dual Schema
Week 11: Parameterized Algorithms: Fixed Parameter Tractable Algorithms, Kernelization, Bounded Search
Week 12: Iterative Compression, Color Coding