

SYLLABUS :-

CS60086      SELECTED TOPICS IN ALGORITHMS Revised Syllabus This course deals with solving computationally difficult problems. The focus is mostly on practically solving NP-hard problems. Three broad modules are to be covered.

A. Deterministic Algorithms Pseudo-polynomial-time algorithms, weak and strong NP-completeness, parameterized complexity. Branch-and-bound algorithms with pruning heuristic. Solving problems by lowering worst-case running time. Local-search algorithms, optimal and suboptimal solutions, exact neighborhood. Relaxation to linear programming, simplex method, rounding, LP-duality, primal-dual method.

B. Approximation Algorithms Approximation ratio, PTAS and FPTAS, approximation algorithms for various graph-theoretic, geometric, combinatorial and optimization problems. Proving inapproximability by reduction.

C. Randomized Algorithms Las Vegas and Monte Carlo algorithms, one-sided, two-sided and unbounded error. Design techniques, foiling the adversary, random sampling, abundance of witnesses, fingerprinting, randomized optimization algorithms, random rounding, randomized multi-start local search. Derandomization, reduction of probability space, method of conditional probabilities.

Books and References

1. Juraj Hromkovic, Algorithmics for Hard Problems, Introduction to Combinatorial Optimization, Randomization, Approximation, and Heuristics, second edition, Springer-Verlag, 2004.
2. Juraj Hromkovic, Design and Analysis of Randomized Algorithms, Introduction to Design Paradigms, Springer-Verlag, 2005.
3. Michael Mitzenmacher and Eli Upfal, Probability and Computing, Randomized Algorithms and Probabilistic Analysis, Cambridge University Press, 2005.
4. David P. Williamson and David B. Shmoys, The Design of Approximation Algorithms, Cambridge University Press, 2011.
5. Noga Alon and Joel H. Spencer, The Probabilistic Method, third edition, John Wiley