CS602
Applied Algorithms
Combinatorial Optimization via Linear & Convex Programming

Instructor: Rohit Gurjar
TAs : Vivek Kumar, Jalay Shah
https://www.cse.iitb.ac.in/~rgurjar/CS602_2022/

Course Contents

- Pre-requisites:
  - CS218/CS601 (not a hard pre-req), expected to know basic algorithm design, augmenting path algorithm for bipartite matching or maximum flow, NP-hardness
  - Linear Algebra (Vector Space, Basis, Null space, Matrix Rank)
  - Graph Theory (paths, trees, DFS, BFS, MST algorithms)
- Course Contents:
  - Matching, Linear Programming Basics, LP Duality, Primal Dual Approach.
  - LP in Combinatorial Optimization: Shortest Path, Bipartite Matching, Maximum Flow General Matching. Primal Dual Algorithm.
  - Convex Programming, Duality, Matching/Max flow via Gradient Descent
  - Interior Point Method for Linear Programming, Matching/Max flow
  - Approximation Algorithms for NP-hard problems: Max SAT, Max Cut via Semidefinite Programming
  - Matroids, Matroid intersection

How will we do it

- Hopefully in classroom.
- Recordings on course webpage. Moodle for communication.
- Mon Thu 17:30-18:55
- Evaluation:
  - Moodle quizzes (15%)
  - Two assignments (10+10%)
  - Paper presentations in groups of two/three (15%)
  - Midsem (20%)
  - Endsem (30%)

References

- Course page from 2020 (https://www.cse.iitb.ac.in/~rgurjar/CS602_2020/CS602.html)

- Alexander Schrijver, Combinatorial Optimization Polyhedra and Efficiency, Vol A,B. Springer, 2004.

- Nisheeth K. Vishnoi. Algorithms for Convex Optimization (freely available online)

- David B. Shmoys and David P. Williamson, The Design of Approximation Algorithms. (freely available online)