

CS 787
Fall 2024
Topics List

Here are the topics I plan to cover. Student interest and/or resistance may cause this list to be modified.

0. What Makes a Great Algorithm?
 - a. Stable Marriages
1. Survey of Design Techniques
 - a. Induction
 - b. Dynamic Programming
 - c. Divide and Conquer
 - d. Collision
2. Linear Programming
 - a. Geometry of Linear Inequalities
 - b. Duality
 - c. Approximation via Dual Fitting
 - d. The Simplex Algorithm
3. Paths, Flows and Matchings
 - a. Shortest Paths and Node Prices
 - b. Flows and Cuts, Unimodularity
 - c. Maximum Flow and Applications
 - d. Bipartite Matching and Vertex Cover
4. Matroids and the Greedy Algorithm
 - a. Linear Programs with Greedy Solutions
 - b. Matroids and Set Systems
 - c. Applications to Matching, Scheduling, etc.
5. Randomization
 - a. Finite Fields
 - b. Factoring Polynomials
 - c. Identity Checking
 - d. General Graph Matching
 - e. Randomized Rounding
6. Nonlinear Techniques
 - a. Convexity and Semidefinite Programming
 - b. Applications: Max-Cut, etc.
 - c. The Ellipsoid Algorithm
 - d. Applications: Matroid Intersection, Directed Paths, etc.
 - e. Submodularity