Approximation Algorithms

1. Analysis of greedy clustering

2. Steiner tree on planar graph

3. Rank aggregation

4. Pricing procedures for repeated ad auctions

5. Analysis of greedy cost-sharing multicast

6. Lift and project and linear programming: Matching

7. Lift and project and linear programming: Maxcut

8. Lift and project and linear programming: Scheduling

9. Graduate course on algorithms, economics and computer science

Analysis of greedy clustering

Take a simple agglomerative greedy algorithm to cluster data to minimize max cluster diameter: how good is the result? (With Aparna Das)

Steiner tree on planar graphs

Given a planar graph and k terminals, connect them as cheaply as possible.

Approximation scheme (with Philip Klein and Cora Borradaile).

Rank aggregation

Given a group of person ranking items, each person giving a permutation, find a permutation which best agrees with everyone's ordering (number of inversions).

Approximation scheme (with Warren Schudy).

Pricing procedures for repeated ad auctions

Google ad auctions sell ads to highest bidders at next highest prices. Participants have incentives to lie.

Analyze natural procedures for repeated bids (with Aparna Das, Anna Karlin, Matt and Yannis).

Analysis of greedy cost-sharing multicast

Greedy multicast algorithm: newcomer connects to root at cheapest current cost, sharing the cost of edges already in use.

Analyze quality of resulting structure (with Moses Charikar and Howard Karloff).

Lift and project and linear programming: Matching

Maximum Matching: given a graph, find a set of disjoint edges of maximum cardinality.

Linear program: to each graph edge $e = \{i, j\}$ associate an integer variable x_e, $0 \leq x_e \leq 1$.

$$\max \sum_e x_e$$

subject to:

$$\forall i, \quad \sum_{e: i \in e} x_e \leq 1.$$

Good: solvable in polynomial time

Bad: solution does not always yield a maximum matching.

Lift and project: systematic way to add constraints in rounds to make the solution progressively closer to a true maximum matching.
Complete analysis of "gap" after k rounds (with Alistair Sinclair).

Lift and project and linear programming: Maxcut

Given a graph, partition into two parts to maximize the number of edges between the two sides.

"Standard" linear program has a gap of 2.

Lift and project does not help reduce the gap (with Fernandez de la Vega).

Lift and project and linear programming: Scheduling

Given a set of tasks with precedence constraints, schedule them on m machines to finish as soon as possible.

"Standard" linear program has a gap of 2.

Lift and project might help reduce the gap (with Moses Charikar and Howard Karloff).

CS 295-8: Computer Science, Algorithms and Economics

Algorithmic mechanism design: Participants follow self-interest. Design truthful mechanism, so that participants have no incentive to deviate from "correct" behavior.

Price of anarchy: Network routing: if each participant routes selfishly, ratio between resulting latency and best achievable latency

Nash Equilibria: existence, computation, quality.

Combinatorial auctions: Items for sale, participants bid on sets of items; approximations

Course Organization: Presentation of research papers

When: M-W 3-4:20, starting Sept 6, 2005

For more information:
http://www.cs.brown.edu/courses/cs295-8/ or email Claire Kenyon, claire@cs.brown.edu