Algorithms

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Two Problems in Approximation Algorithms

Problem 1: Algorithms, auctions, economics, truthful mechanisms
Problem 2: Online algorithms, graph problems
A Pricing Problem

**Goal:** Understand how a seller can price items to maximize revenue

**Setting:** Customers have preferences. A customer wants to buy at most one item (ex. selling houses or in-flight movies)

Story

1. Seller with store sets prices on items for sale
2. Consumers arrive at store
3. Item prices and consumer valuations induce preferences
4. Consumers must agree on allocation of items

Goal: How does seller price items such that agreement is possible and profit is maximized?
Model

- Seller sets price $p_j = 10$ for item $j$
- Consumer $i$ has valuation $v_{ij} = 15$ for item $j$
- Consumer $i$ has utility $v_{ij} - p_i = 5$ for item $j$
- Consumer $i$ desires item of maximum non-negative utility for her
- Agreement: must have allocation such that all consumers are happy
Online $k$ median

Goal: Understand where to open a chain of stores, one after the other, planning for possible future expansion of the company

Setting: Customers go to the nearest store

Collaborators: Marek Chrobak, Neal Young (UC Riverside). In preparation.
Story

1. We are given $n$ locations of customers and can open a store at any of these locations
2. Stores open one by one, at each step we choose the location of the next store
3. The cost of the current locations is the distance from consumers to stores

Goal: How do we plan the locations of successive stores such that at any point in time, the cost is minimized?
Model

- Given $n$ points and distances forming a metric space
- Order the points in a sequence $p_1, p_2, \ldots, p_n$
- At time $k$, the cost is the sum over $i$ of the distance from $i$ to $\{p_1, \ldots, p_k\}$.
- Algorithms: greedy, reverse greedy, hierarchical, \ldots
Other areas of interest

- Bin-packing, scheduling approximation algorithms
- Low distortion metric embeddings
- Clustering, MaxCut, approximation schemes
- Monte-Carlo Markov chains
- Probabilistic analysis of algorithms