Alchemist by Juame Plensa (location: MIT W20)

Discrete Optimization II

15.060: Data, Models, and Decisions
Podimata, Ramakrishnan, Yao
Class 17 (Nov 19)

A Classification of Optimization Problems

		Decision Variables	
		All continuous	Some (or all) integer
Objective Function & Constraints	All linear	*Linear Optimization* ✅	*Integer Linear Optimization**
	Some (or all) non-linear	*Nonlinear Optimization*	*Integer Nonlinear Optimization*

* also known as Discrete Optimization

Recap: The Power of Binary Variables

- Binary variables:
  - Are very useful to model business decisions that involve doing something or not doing something (as opposed to how much of something to do) …
  - … but make solving an optimization model more challenging

- Binary variables allow us to model IF-THEN relationships and non-linearities using "tricks" so that the formulation remains linear.

- A vast array of real-world decision problems can be modeled with binary variables

Today's Class

- Today, we'll tackle another discrete optimization problem, this time in **supply-chain management**.

- This problem falls under the umbrella of **matching** problems (more on this later), a broad category of real-world problems that discrete optimization is particularly well suited to solve.

- We'll start with a base formulation. Then, as an in-class exercise, you'll be responsible for **modifying the formulation** to account for some real-world changes

Optimization in Supply Chains

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- Examples where supply chain network optimization is performed:
  - Expansion into a new market
  - Launching a new product
  - Evaluating mergers and acquisitions
  - Responding to supply, demand, or distribution disruptions
  - Responding to cost, demand, or other economic realities
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  - Simply evolving to adapt to changes in the business environment

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- **Optimization is a critical success factor in supply chain design and operation worldwide**

Any Supply Chain experience?