MATLAB for Finance

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Introduction to Optimization

Modeling

- *Modeling is a means for representing reality in an abstracted way*

Reasons to model

- *understanding simpler situations* resembling complex situations of reality
- *optimize* the use of resources
- *testing alternative* operational scenarios
- educate and provide experience for *model-builders*

source: http://en.wikibooks.org/wiki/Fundamentals_of_Transportation/Modeling

Optimization

- Mathematical optimization or optimization or mathematical programming
- In mathematics, computer science, or management science is:

> *The selection of a* ***best*** *element (with regard to some criteria) from some set of available alternatives*

source: http://en.wikipedia.org/wiki/Mathematical_optimization

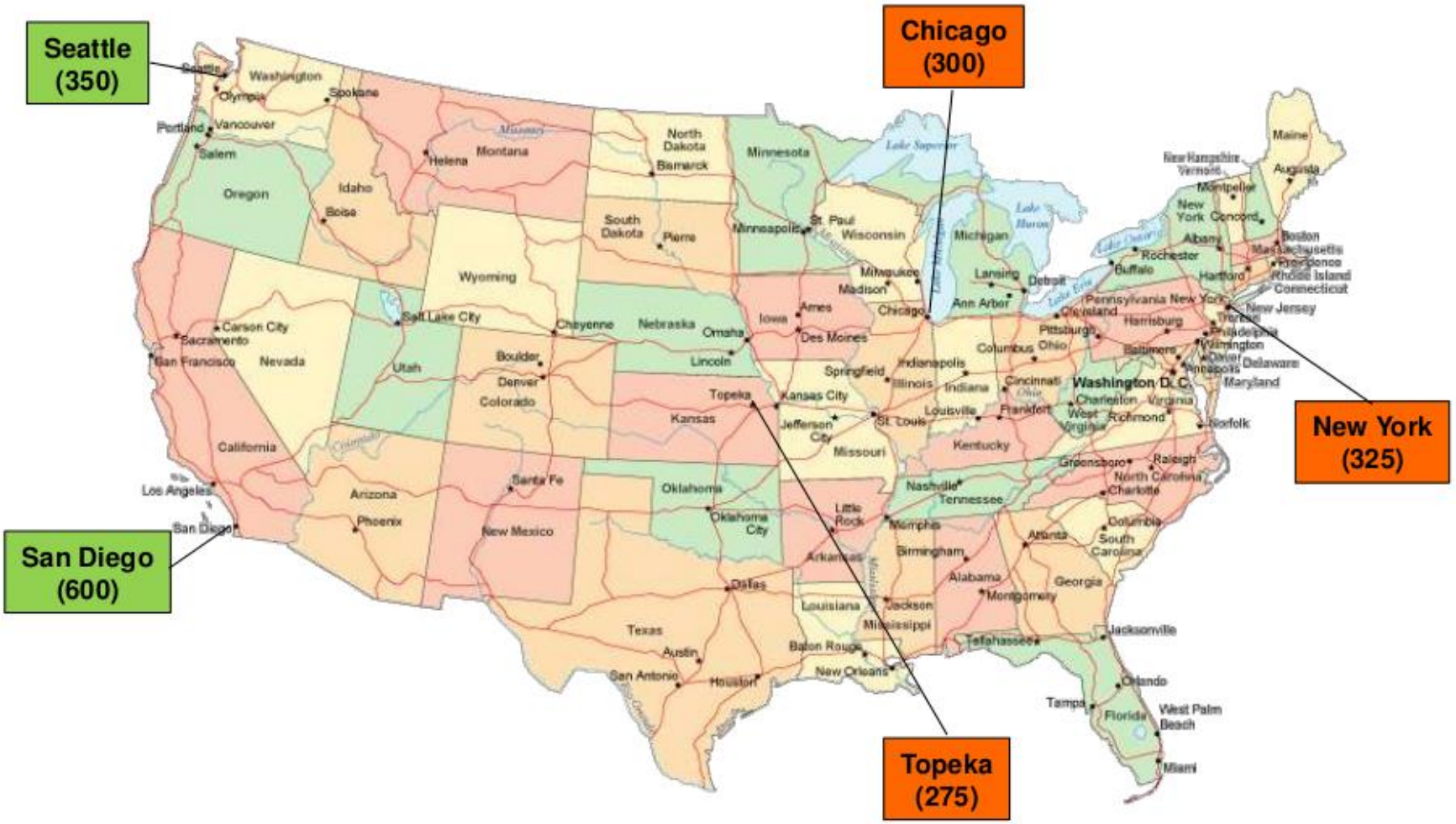
A Transportation Model

- Find the **optimal delivery** of products from 2 plants (San Diego, Seattle) to 3 markets (New York, Topeka, Chicago)

- Minimize costs of transportation, satisfying markets demand under supply constraints:

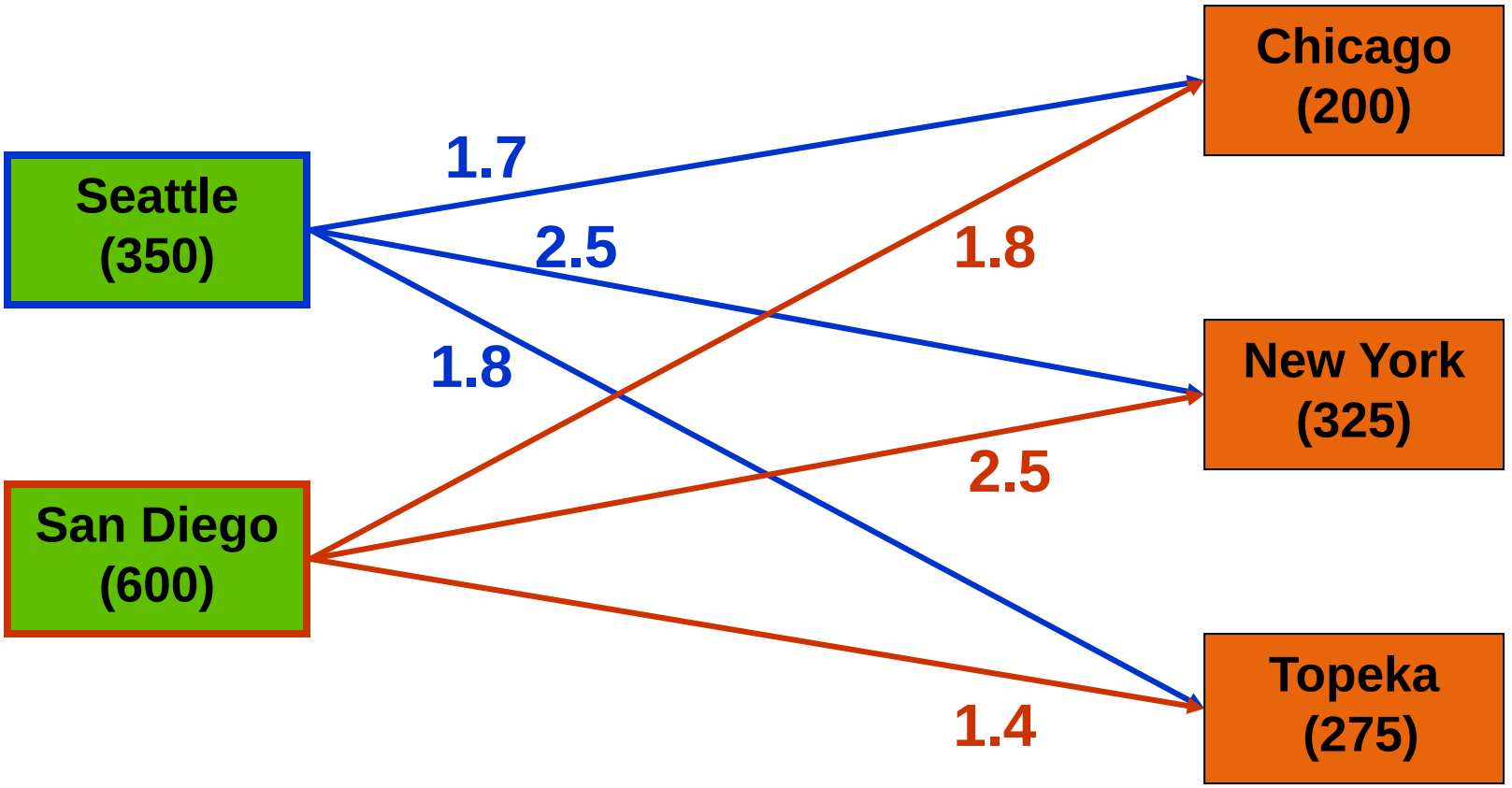
Minimize	Transportation cost
subject to	Demand satisfaction at markets
	Supply constraints

A Transportation Model



source: http://www.gams.com

A Transportation Model



Minimize	Transportation cost
subject to	Demand satisfaction at markets
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Model Formulation

Indices: i (Canning plants)

j (Markets)

Decision variables: x_{ij} (Number of cases to ship)

Parameter: c_{ij} (Transport cost per case)

$\min \quad \sum_i \sum_j c_{ij} \cdot x_{ij}$ (Minimize total transportation cost)

subject to

$\sum_j x_{ij} \leq sup_i \quad \forall\, i$ (Shipments from each plant $\leq$ supply capacity)

$\sum_i x_{ij} \geq dem_j \quad \forall\, j$ (Shipments to each market $\geq$ demand)

$x_{ij} \geq 0 \qquad \forall i, j$

$i, j \in \mathbb{N}$