



# Examining Hotelling's law

CS-302 Modeling and Simulation  
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# Problem

- Different stores will apply different strategies to compete with each other, these strategies include actions like changing price of product, changing location of store, etc.
  - Hotelling's law: **"There is an undue tendency for competitors to imitate each other in quality of goods, in location and in other essential ways."**
- Purpose: Model different strategies using Cellular Automata by defining rules for store actions and then observing collective behavior and examining Hotelling's law

# Model

- Cellular Automata based model. Each cell represents either Customer or Store.
  - If customer then value will be preferred store number.
  - If store then value will be store number (shifted by total number of stores to differentiate from customer cell).
- Assumptions
  - Consider only changing location of store and price of product (same and only one product at each store) as actions
  - All stores apply same set of rules for actions
  - All stores will follow same strategy
  - Instantaneous change in Customer preference

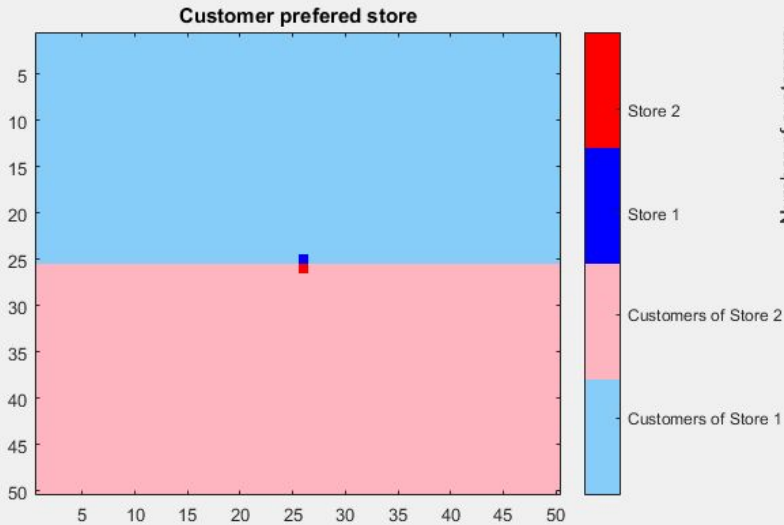


# Rules



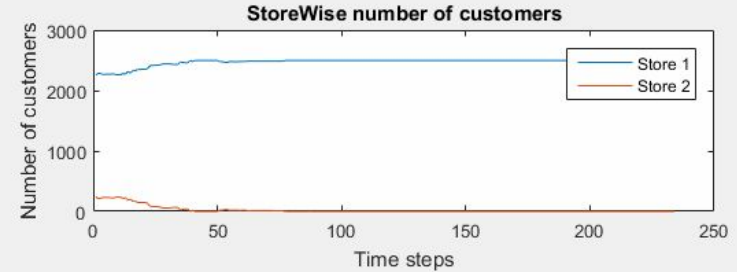
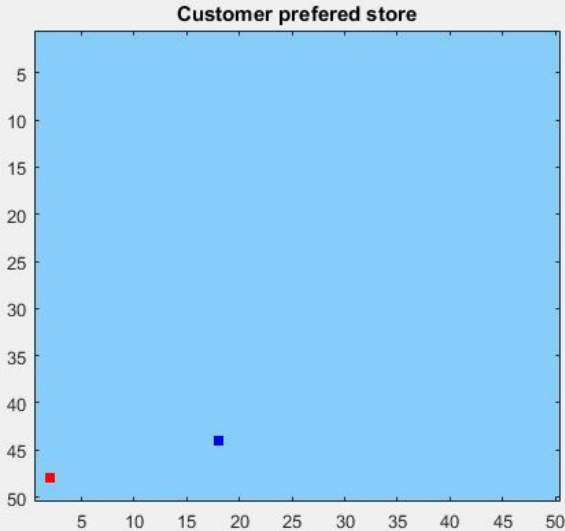
- Store Action: Changing location
  - Store will choose one of the 4 directions which are possible and unfilled.
  - If there is no any such direction then it will stay.
  - Else it will check share of customers at new position.
    - If share of customer is higher than previous, then it will move to new location
    - Else it will stay
- Store Action: Changing price
  - If customer share of store is higher than equally distributed customer share ( $1/(\text{Number of stores})$ ), then it will increase price by constant value
  - Else keep it constant or decrease it by constant randomly
- Rule for customer: Customer will buy product from only one store which offers lowest cost according to new defined cost formula ( $\text{cost} = \text{price} + \text{physical distance bet. Customer and store}$ )

# Strategy 1: Change Location Only (Same prices)

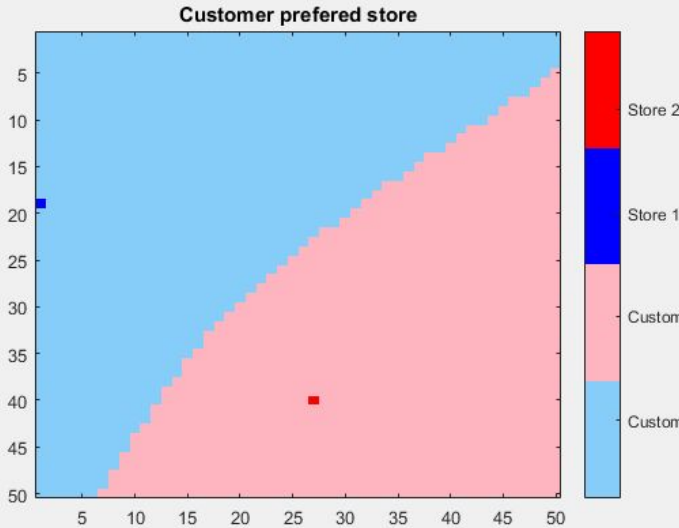


Real world interpretation: Vendors on the beach

# Strategy 1: Change Location Only (Different prices)

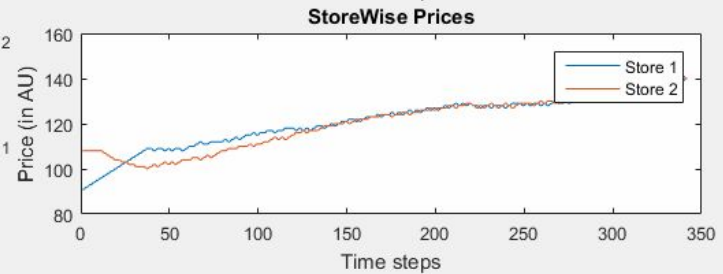
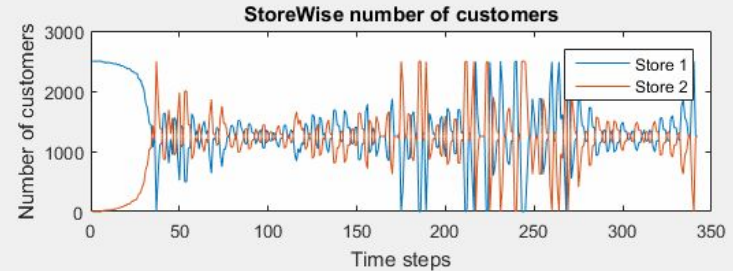


# Strategy 2: Change Price Only



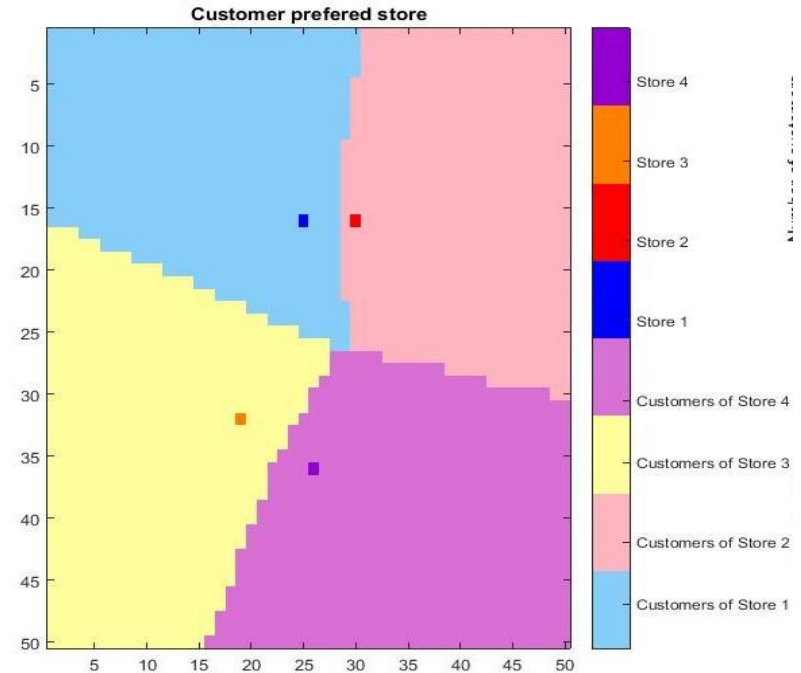
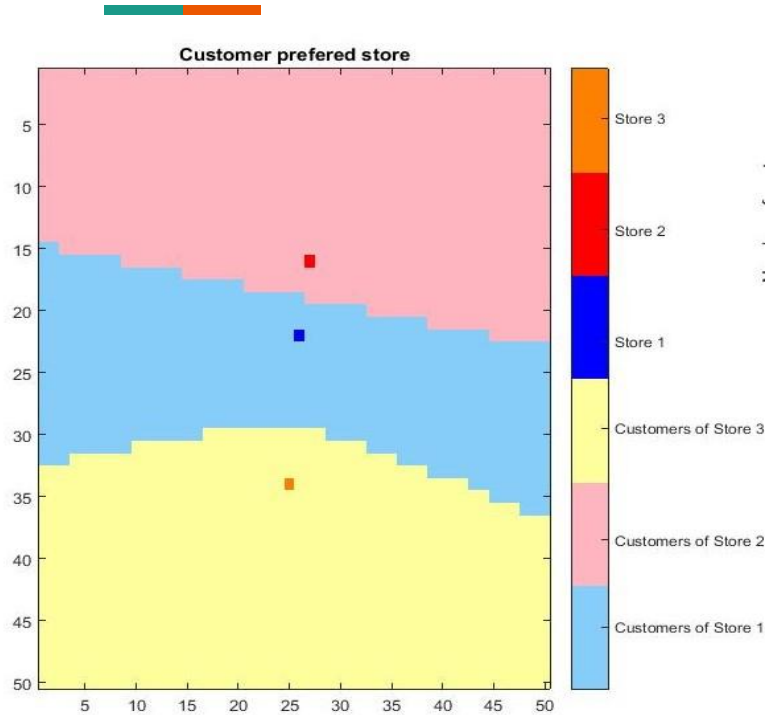
Real world interpretation: Store at the Centre of City vs. Store on Outskirts

# Strategy 3: Alternate Change in Price and Location





# Higher number of stores & Strategy 3





**Any Questions?**