Algorithms for online marketplaces

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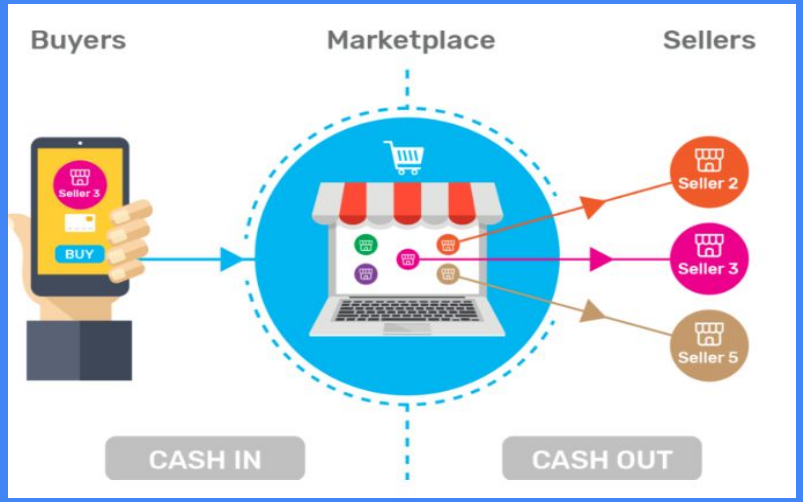


What’s there to optimize?

Criteria:

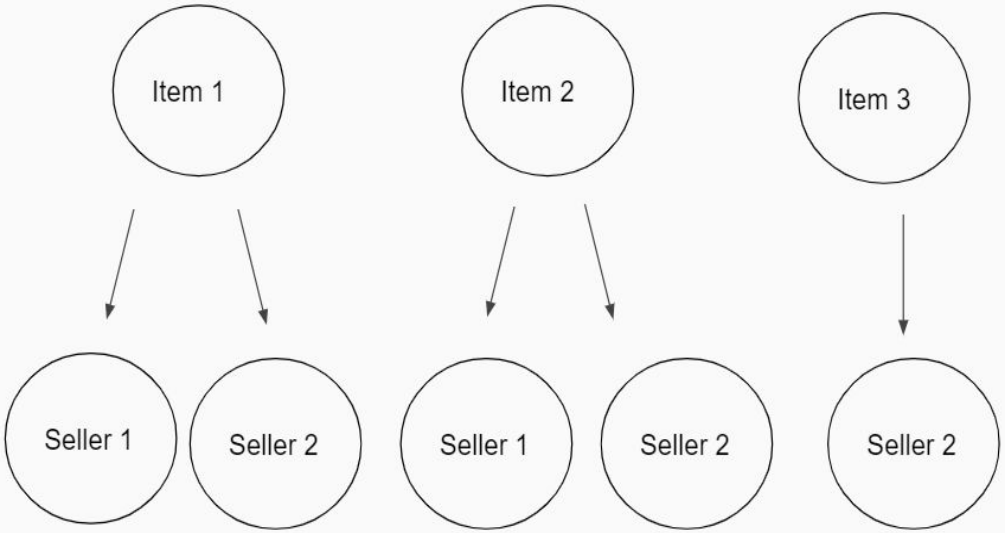
- Marketplace of equally valuable items
- Each item available at many sellers
- Customers places bulk order
- Sellers apply unit prices for their items
- Sellers apply **quantity discounts**

Choosing seller for each item yielding the lowest possible total price is not trivial

Outline

1. Problem clarification
2. Possible solutions
3. Our solution in detail

Problem clarification



Quantity	Seller 1	Seller 2
1	3	4
2	2	3
3	1	2

Trivial solution: 8
Item 1: Seller 1
Item 2: Seller 1
Item 3: Seller 2

Possible solutions

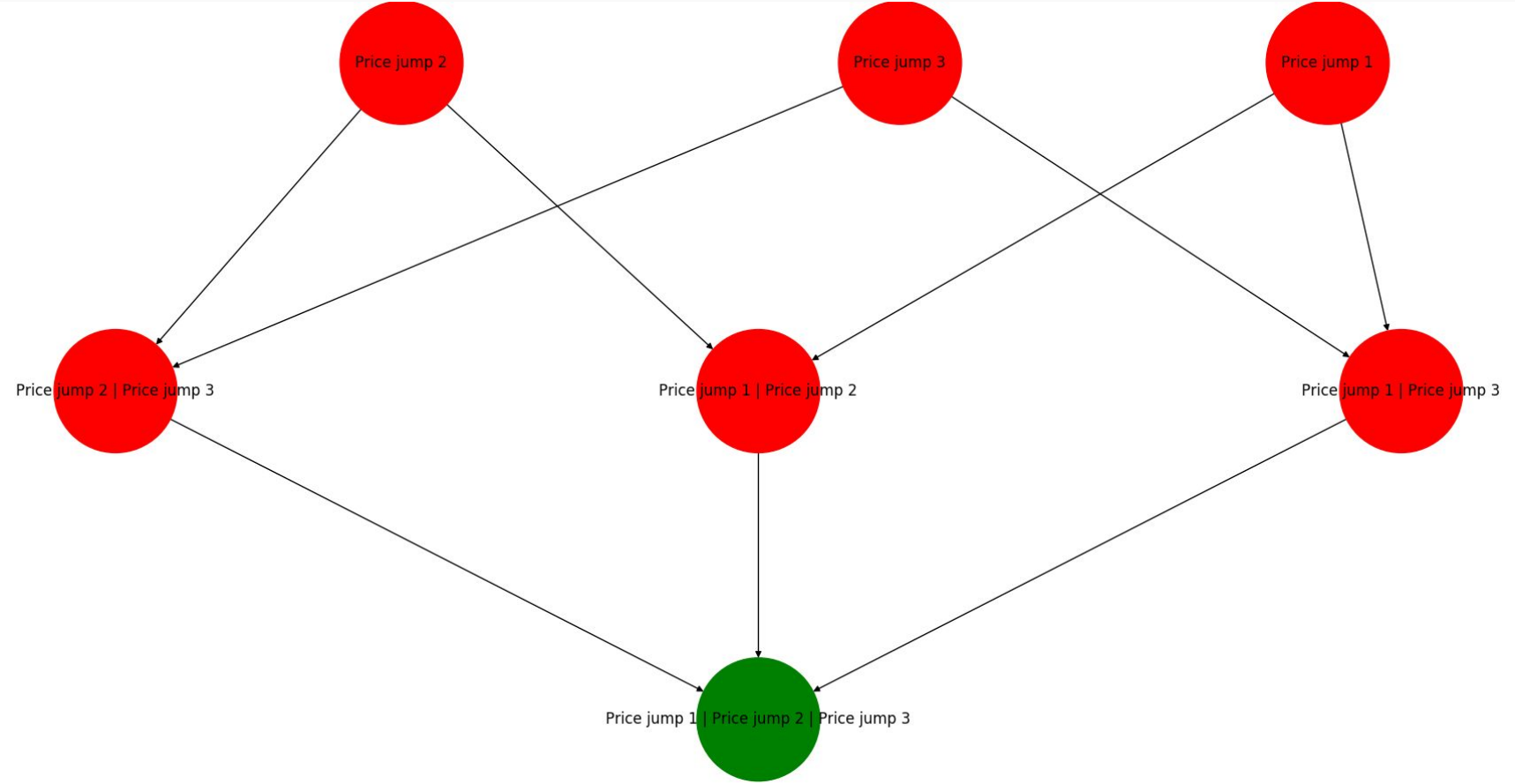
- NP complexity class
- Brute-force method
- Genetic-type algorithms
- **Price jump**

  combinations method

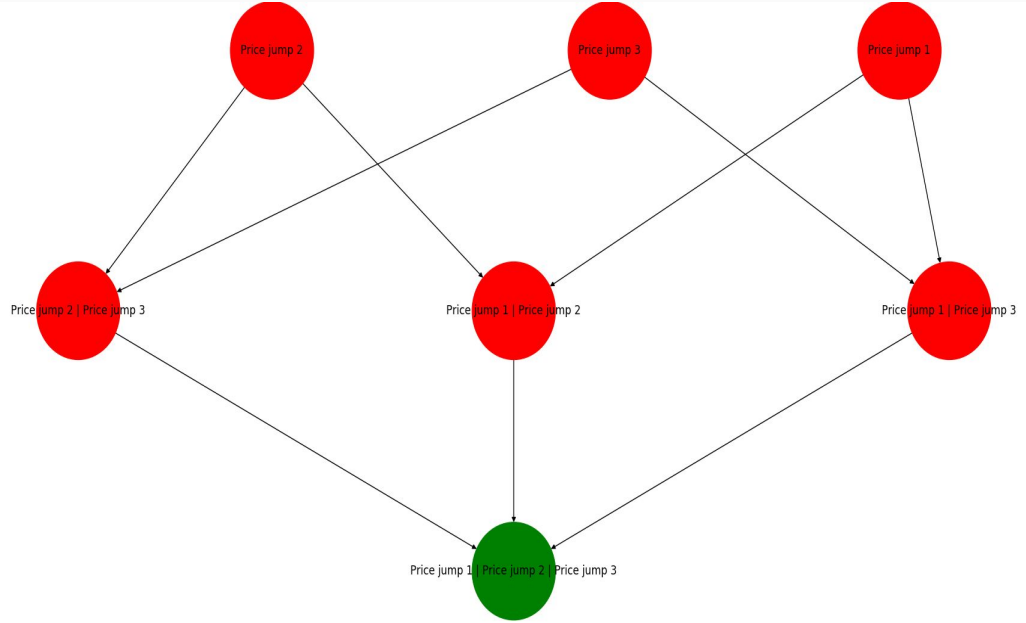
Quantity	Seller 1	Seller 2
1	3	4
2	2	3
3	1	2

Item 1	Item 2	Item 3	Price
Seller 1	Seller 1	Seller 2	8
Seller 1	Seller 2	Seller 2	9
Seller 2	Seller 1	Seller 2	9
Seller 2	**Seller 2**	**Seller 2**	**6**

Price jump combinations method



Price jump combinations method



3-combination reached within time limit
Customer has to pay much lower price
Online Market did a great job

Monte-Carlo Tree Search (MCTS):

1. Initial setup
2. Forward update
3. Selection
4. Rollout/simulation
5. Price calculation
6. Backward update

Exploration-exploitation:
Trade off → SA (T)

The End

- All this for a single customer
- What would be the natural step to even lower the prices or simply make more profit?

Thank you for the attention!