Privately Solving Assignment Problems

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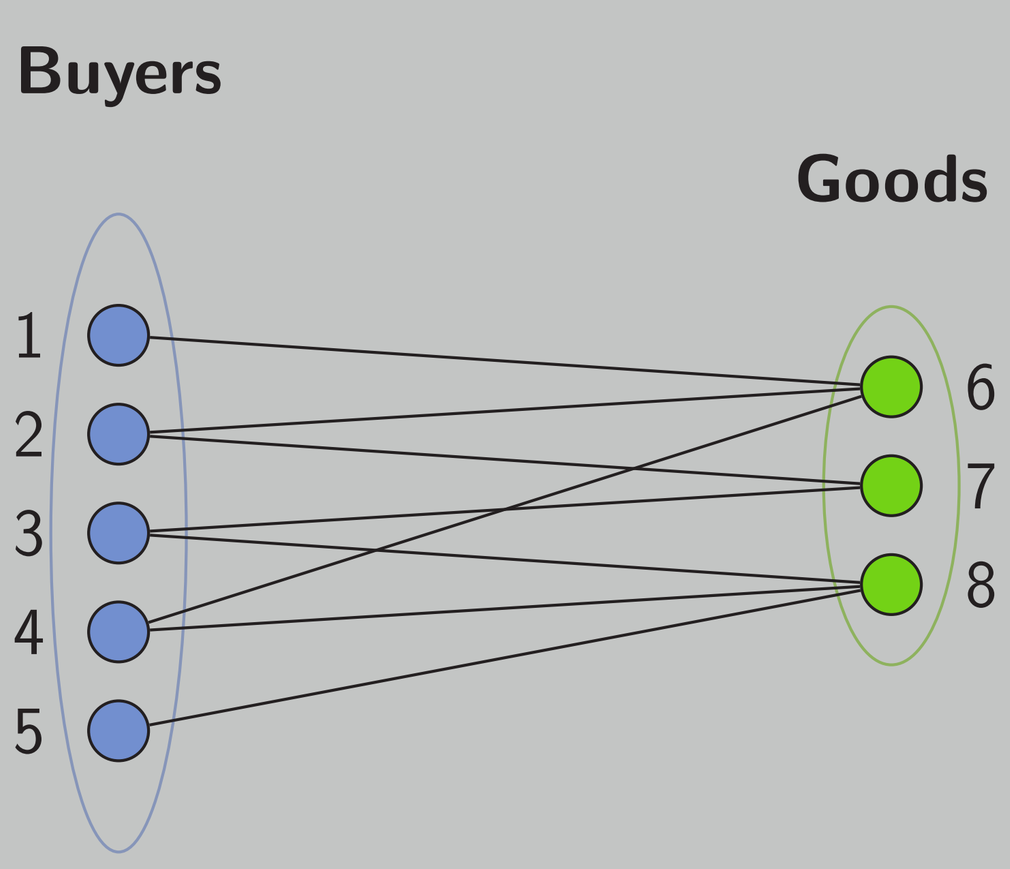
The Problem



- Match bidders to preferred goods
- What if preferences are private?
- Impossible under differential privacy

Ascending price auctions [KC82]

- Bidders bid on goods
- Maintain price for each good, raise when no more supply
- Intuition: deferred acceptance
- Walrasian equilibrium

Joint differential privacy [KPRU13]

- Arbitrary coalitions of bidders can't learn remaining bidders' preferences

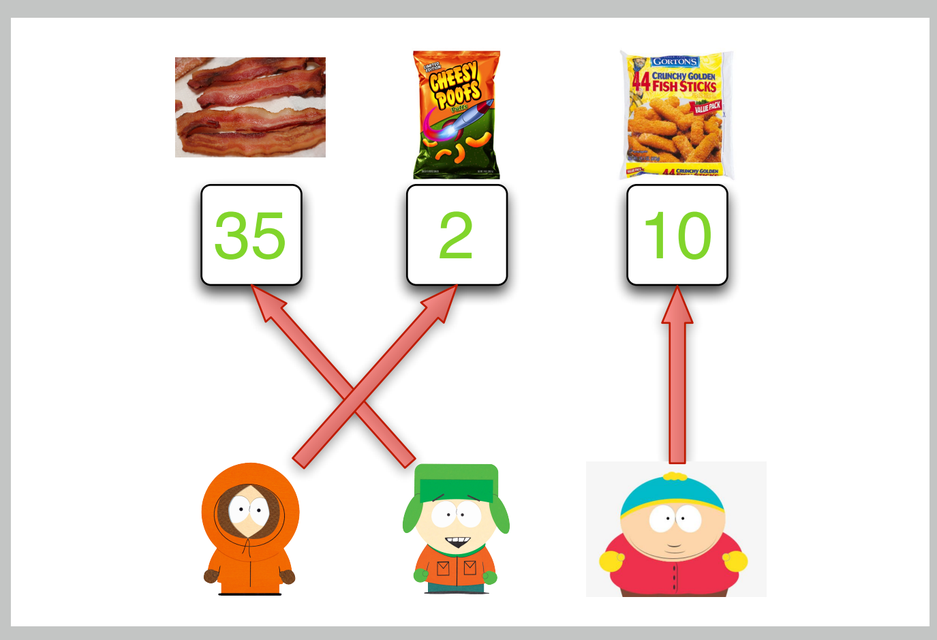
Private counter [CSS10/DNPR10]

- Privately release running count of a stream

Putting it all together

1. Ascending price auctions on each good
2. Publish count of bids on each good
3. Bidders infer prices, submit bids
4. Each bidder knows what to get

In a picture...



Large supply

- Private counters, noisy may oversell
- Solution: distinct types of goods
- Assume large supply of each

Extensions and lower bounds

- Works for gross substitutes valuations
- Standard differential privacy: impossible
- Joint differential privacy: large supply

Conclusion

- Prices = "low information" $\Rightarrow$ privacy
- Other auctions via counters?

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