

Distributed Optimization and Games

Auctions

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Outline

□ Preliminaries

- Auctions
- Matching markets

□ Possible approaches to ads pricing

□ Google mechanism

□ References

- Easley, Kleinberg, "Networks, Crowds and Markets", ch.9,10,15

Google's GSP auction

- ❑ Generalized Second Price
- ❑ Once all the bids are collected $b_1 > b_2 > \dots > b_N$
- ❑ Company i pays b_{i+1}
- ❑ In the case of a single good (position), GSP is equivalent to a 2nd price auction, and also to VCG
- ❑ But why Google wanted to implement something different???

GSP properties

- Truth-telling may not be an equilibrium

GSP example

Ads positions

1 $r_1=10$

2 $r_2=4$

3 $r_3=0$

companies

a $v_a=7$

b $v_b=6$

c $v_c=1$

r_i : click rate for an ad in position i
(assumed to be independent
from the ad and known a priori)

v_i : value that company i
gives to a click

- If each player bids its true evaluation, a gets a payoff equal to 10
- If a bids 5, a gets a payoff equal to 24

GSP properties

- ❑ Truth-telling may not be an equilibrium
- ❑ There is always at least 1 socially optimal NE

GSP example

Ads positions

1 $r_1=10$

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Multiple NE

- a bids 5, b bids 4 and c bids 2
- a bids 3, b bids 5 and c bids 1

GSP properties

- ❑ Truth-telling may not be an equilibrium
- ❑ There is always at least 1 socially optimal NE
- ❑ Revenues can be higher or lower than VCG
 - Attention: the revenue equivalence principle does not hold for auctions with multiple goods!
 - Google was targeting higher revenues...
 - ... not clear if they did the right choice.

GSP example

Ads positions

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companies

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□ Multiple NE

○ a bids 5, b bids 4, c bids 2 → google's revenue=48

○ a bids 3, b bids 5, c bids 1 → google's revenue=34

□ With VCG, google's revenue=44

Other issues

- ❑ Click rates are unknown and depend on the ad!
 - Concrete risk: low-quality advertiser bidding high may reduce the search engine's revenue
 - Google's solution: introduce an ad-quality factor taking into account actual click rate, relevance of the page and its ranking
 - Google is very secretive about how to calculate it => the market is more opaque
- ❑ Complex queries, nobody paid for
 - Usually engines extrapolate from simpler bids