CS 103: Lecture 13 Sponsored Search Markets
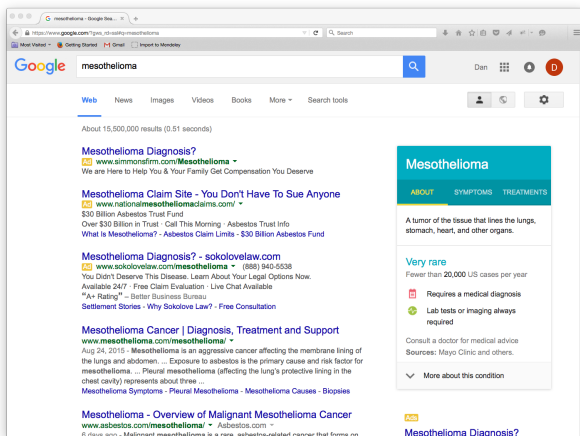
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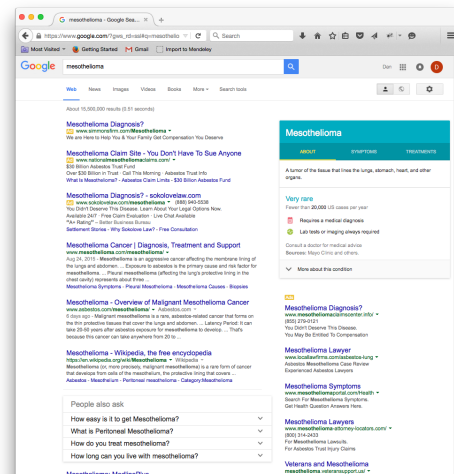
Announcements

- No HW this week
- Next HW assigned this week, due next Th
- Midterms...

Sponsored Search: "Mesothelioma"

Sponsored Search

Sponsored Search

There is big money in paid search advertising:

Top 10 Most Expensive Keywords by Avg. CPC U.S. Google Desktop Text Ads, Jan.-June 2015	
Keyword	**Cost Per Click**
mesothelioma attorneys tx	$272.00
mesothelioma attorney maryland	$262.44
alabama mesothelioma attorney	$244.30
nevada mesothelioma attorney	$238.28
insurance structured settlements	$232.33
virginia mesothelioma lawyers	$226.66
settlement annuity payments	$211.21
hawaii mesothelioma lawyers	$209.62
mesothelioma attorney ct	$209.41
virginia mesothelioma attorney	$208.32

AdGooroo 2015

Sponsored Search

Keywords with most *revenue* (clicks x cost per click):

Top Keywords by Paid Search Ad Spend U.S. Google Desktop Text Ads, January-December 2014					
Keyword	**Spend**	**Impressions**	**Cost Per Click**	**Clickthrough Rate**	**# of Advertisers**
free credit report	$46,346,533	185,254,020	$7.74	3.23%	68
car insurance	$33,965,014	42,711,862	$27.98	2.84%	135
car insurance quotes	$32,991,815	28,869,702	$32.35	3.53%	127
at&t	$28,553,563	243,567,198	$1.15	10.24%	44
auto insurance	$27,855,182	30,250,530	$32.08	2.87%	133
cheap flights	$24,644,876	536,945,887	$1.55	2.95%	123
U S P S	$24,474,907	243,973,773	$0.87	11.55%	34
mesothelioma	$24,045,210	10,590,837	$82.69	2.75%	129
iphone 6	$22,426,800	336,849,478	$0.79	8.42%	47
rheumatoid arthritis	$21,527,599	36,812,604	$13.44	4.35%	136
flowers	$20,434,631	154,427,567	$5.41	2.45%	93
dryers	$18,361,331	157,223,407	$1.51	7.72%	129
auto.insurance	$17,474,934	17,736,636	$33.49	2.94%	71
auto insurance quotes	$17,213,973	15,614,648	$30.93	3.56%	112
hulu	$17,102,690	119,865,675	$0.96	14.80%	8
engagement rings	$16,462,086	103,177,335	$5.33	3.00%	178
insurance quotes	$15,992,321	20,346,015	$25.71	3.06%	194
health insurance	$15,732,005	66,412,834	$8.38	2.83%	278
student loans	$15,521,434	54,053,318	$10.56	2.72%	205
mortgage calculator	$15,288,708	270,744,344	$1.47	3.84%	441

Sponsored Search

How does this all work?

Board work: sponsored search as a matching market

VCG Mechanism

Auction mechanism for matching markets. General setup:

- Ask buyers to announce valuations for items (need not be truthful!)
- Assign items to buyers
- Charge price p_{ij} to buyer j if she receives item i

Problem: people may lie. How can we do this so that announcing true valuation is a dominant strategy?

VCG Mechanism

- Ask buyers to announce valuations for items
- Compute *optimal* assigment of items to buyers using announced valuations (how?)
- Charge price p_{ij} to buyer j if she receives item i **based on VCG mechanism**

Board work: derive VCG mechanism

VCG Mechanism Recap (1)

Setup:

- Sellers S, buyers B
- V_B^S: maximum total valuation of perfect matchings with this set of sellers and buyers
- $B - j$: set of buyers with j removed
- $S - i$: set of sellers with i removed
- V_{B-j}^S: how well bidders other than j would do if buyer j **does not participate**
- V_{B-j}^{S-i}: how well bidders other than j do if buyer j **does participate**

VCG Mechanism Recap (2)

VCG price when buyer j gets item i = "harm" done to other buyers by allocating item i to player j:

$$p_{ij} = V_{B-j}^S - V_{B-j}^{S-i}$$

(value when i doesn't participate) - (value when i does participate)

Correctness of VCG

Claim: telling the truth is a dominant strategy for buyers in the VCG mechanism

Proof sketch on board

Generalized Second Price Auctions

The VCG mechanism is not used in practice. Search engines have converged instead on the *Generalized Second Price* (GSP) Auction.

Can you guess how this works?

Assign slots in order of bids. For the ith slot, charge the prices of the $(i + 1)$st highest bid.

Generalized Second Price Auctions

Some facts about GSP:

- Invented by Google
- Truth-telling is not a dominant strategy. **Example**
- There can be multiple Nash equilibria. **Example**
- But there is always one that is socially optimal
- Because there can be multiple equilibria, it is hard to make specific theoretical predictions

Discuss: then why does Google use it?