

CS1951k/2951z, Spring 2020



Massive Market



Global Forecast Update Dec. 2016

M/GNA

Key Findings

 Globally, advertising revenues demonstrated
 their strongest growth since 2010 this year, as advertising sales reached \$493 billion

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- Global ad growth will slow noticeably in 2017,
 to +3.6%
- Social and search captured the bulk of dollar growth in 2016: \$23 billion out of \$26 billion
- TV ad sales resilient due to stronger pricing and cyclical events including sports and US elections
- Digital ad sales to surpass TV by 2017
- US ad sales grew nearly 7% to \$180 billion, achieving its strongest growth in 12 years

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Massive Market – Example

Google AdWords: **72 billion dollars** worth of payper-click advertisements were purchased in 2015.

This was 97% of Google's overall income in 2015.



Ad Exchange & Ad Networks

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An on-line **advertising network** or **ad network** is a company that **connects advertisers** to web sites that want to host advertisements.

Ad Exchange – Schematic Cartoon

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Ad Network Challenge

Fulfill advertising contracts at minimum cost

while sustaining and attracting advertisers by

achieving high-quality targeting.

Trading Agent Competition - AdX



One of many Trading Agent Competition Games.

In a nutshell: the game reflects the challenges faced by an Ad Network as it bids for display ads opportunities.

https://sites.google.com/site/gameadx/





Game Server

TAC AdX – Bird's Eye View

Agents

Implement a strategy for the Ad Network challenge, i.e., perform a bidding strategy.

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Game Server

Simulates the behavior of users, web sites, advertisers, and an Ad Exchange for a number of days.

Next Lab: One Day Game BROWN

We will play a simplified version of AdX game.

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In this simplified version we care only about:

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Campaigns

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In this simplified version we care only about:

- Campaigns
- Impression Opportunities

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A campaign is defined by:

A market segment: a demographic(s) to be targeted.

A **reach**: the number of ads to be shown.

A **budget**: the amount of money the advertiser will pay if this contract is fulfilled.





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One Day Game - Impressions Market

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Each impression opportunity is allocated via a second price auction.



Agent 2

Agent n

Server

One Day Game - Mechanics

Start of the Simulated Day





Agent n





Agent 2

Agent n

Server

One Day Game - Mechanics

10 seconds





Agent 2

Server

Agent n






Agent 2

Agent n

Server



Simulate impressions one at a time.







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For each impression:

Run second price auction. Allocate and price impression.



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Compute statistics for each agent.13



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One Day Game – Agent Evaluation

Agents are evaluated by the profit obtained from their campaign as:

$$\operatorname{profit}(\overrightarrow{x}) = \min\left(\frac{\operatorname{valid}(\overrightarrow{x})}{\operatorname{reach}}, 1\right) \cdot \operatorname{budget} - \operatorname{price}(\overrightarrow{x})$$

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• Complicated complimentary structure.

One Day Game - Summary BROWN

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Knowing:

- 1. Distribution of impressions
- Number and distribution of campaigns (but not *exactly* other agents' campaigns!)

One Day Game – Users' Distribution

Segment	Avg. # of Users	
Male, Young, Low Income	1,836	
Male, Young, High Income	517	\mathcal{I}
Male, Old, Low Income	1,795	
Male, Old, High Income	808	
Female, Young, Low Income	1,980	
Female, Young, High Income	256	
Female, Old, Low Income	2,401	
Female, Old, High Income	407	

Distribution derived from data found in www.alexa.com

Strategies for the One Day Game

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ENG

Can you think of one?

Waterfall Heuristic

- The game is complicated by at least two factors:
 - random order of impressions
 - random campaigns of other agents.
- Suppose
 - other agent's campaigns are known
 - other agents bid truthfully (budget/reach)

Waterfall Heuristic (cont.)

- Waterfall heuristic solve for an allocation and a matrix of prices. An agent playing Waterfall strategy builds an internal representation of the market and runs the Waterfall algorithm.
- Prices for each market segment resemble a "waterfall", where campaigns with higher budget/ reach are served first and pay the price of the campaign with immediate lower budget/reach.






































































Prices (per impression)































Waterfall Heuristic (cont.)

• Waterfall takes you only so far!

• Waterfall works **IF** you know the exact configuration of the market.

 How would you use this algorithm if you don't know other agent's campaigns? and supply?

Image Credits

- Electronic Advertisement (Ads)
 - webcapitaltop.com/servicios/campanas-display
- Google Ad Words
 - www.entrepreneur.com/article/292119
- Ad Exchanges
 - www.openx.com
 - www.doubleclickbygoogle.com
 - www.playbuzz.com
- Campaigns
 - https://www.greentechmedia.com/articles/read/how-energy-efficiency-marketers-arelearning-about-market-segmentation-from#gs.UJQaMxI
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