LEARNING REVENUE MAXIMIZING ORDERINGS IN SEQUENTIAL AUCTIONS

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The ordering of auctions changes the total revenue collected by the auctioneer

Two agents: A1, A2

Two types of flowers: Tulip, Rose
A1: v(T) = v(R) = 5, with budgets 5
A2: v(R) = 4, with budgets 4

Two possible orderings:
<T, R> T -> A1, R->A2; with revenue 9
<R, T> R -> A1, T is unsold; with revenue 5

Two agents: A1, A2

Two types of flowers: Tulip, Rose
A1: v(R) = 1, v(T)=1, v(T, R) = 10
A2: v(R) = 5

Two possible orderings:
<R, T> R -> A2, T->A1; with revenue 6
<T, R> T -> A1, R -> A1; with revenue 10

CAUSES OF REVENUE CHANGE

Budget constraints: items are unsold because agents that want them have no money left
Combinatorial preferences: parts of combinatorial preferences are already sold to others

Historical data can be used to learn these good orderings

1: LEARNING TO ORDER AUCTIONS

Given historic data of auctions:
The ordering of items
Prices of the items
Who bought the items
Find a model for the expected revenue of an order

Type	Revenue	R before	R after	T before	T after	Sum	Sum R	Sum T	Mean R	Mean T
R	10	0	3	0	4	0	0	0	10	4
R	8	1	2	0	4	10	10	0	11	4
T	4	2	2	0	3	18	18	0	11	4
R	8	2	1	1	3	22	18	4	14	4
T	6	3	1	1	2	30	26	4	14	3
T	3	3	1	2	1	36	26	10	14	3
T	3	3	1	3	0	39	26	13	14	NA
R	14	3	0	4	0	42	26	16	NA	NA

2: OPTIMIZE GREEDILY

Use learned models to select an item that
maximizes the expected reward
Order this item first, and iterate for the next position

EXPERIMENTAL SETTING

	Rose	Tulip	R+T	Budget
Agent 1	10	-	-	10
Agent 2	6	-	-	100
Agent 3	8	5	-	20
Agent 4	4	3	20	100

	Rose	Tulip	Lily	Orchid	R+T	R+L	Budget
Agent 1	8-12	-	-	-	-	-	10-30
Agent 2	-	3-7	6-10	-	-	-	10-30
Agent 3	-	-	-	13-17	-	-	10-30
Agent 4	2-6	2-6	-	-	20-25	-	10-30
Agent 5	2-5	-	2-5	-	-	26-30	10-30

EXPERIMENTAL RESULTS

Ordering 4 roses and 4 tulips:

Run 40 simulations using random orderings;
Remove orderings with an optimal revenu;
Translate the orderings + revenues to a data set;
Learn models, and run the greedy algorithm

In 8 out of 10 times, the result is an optimal sequence

Randomized auctions:

The participants are randomly selected;
Utility functions and budgets are drawn uniformly;
Flowers are randomly selected
Run 250 simulations using random orderings
Create data set, learn models, run the greedy algorithm

ordering	mean revenue
random	131
our method	135
best found	136.5
most valuable first	128

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