



# Uppsala University

## Industrial Algorithms

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Founded 2000  
7 offices around the world  
20 employees



# World-class Negotiation platform

## Sourcing and Optimization



# Spend Analysis Contract Management



# Combinatorial Auctions



## Sell Auction Example

	Bid 1	Bid 2	Bid 3	Bid 4
Lot 1	X	X		
Lot 2			X	X
Lot 3		X	X	
Lot 4	X	X		X
Value	10	24	15	9



# Integer Programming

## Operations Research 2000





	Bid 1	Bid 2	Bid 3	Bid 4
Lot 1	X	X		
Lot 2			X	X
Lot 3		X	X	
Lot 4	X	X		X
Value	10	24	15	9

Maximize:

$$10 \times \text{Bid1} + 24 \times \text{Bid2} + 15 \times \text{Bid3} + 9 \times \text{Bid4}$$

Such That:

$$\text{Lot 1: Bid1} + \text{Bid2} = 1$$

$$\text{Lot 2: Bid3} + \text{Bid4} = 1$$

$$\text{Lot 3: Bid2} + \text{Bid3} = 1$$

$$\text{Lot 4: Bid1} + \text{Bid2} + \text{Bid4} = 1$$



- Sell instead of buy auctions
  - Give a sell price per Lot
- Discounts and Restrictions



## Buy Auction Example

	Bid 1	Bid 2	Bid 3	Solution
Lot 1	100	114	113	102.6
Lot 2	100	114	110	99.0
Lot 3	100	115	108	97.2
Lot 4	100	115	110	99.0
Lot 5	100	106	110	95.4
Restrictions	Max 3	Max 3	Max 3	493.2
Discounts		≥2 → 10%	≥2 → 10%	



# Hash tables



- Standard in modern PL
- Tested by millions of programmers
  - Adequate for many problems



- Millions of entries
- Several dimensions



Key	Value
h(y)	
h(A)	

Key	Value
h(B)	

Key	Value
h(C)	4711





# Edit Distance



The number of string edits needed to turn one string into another.



# Dynamic Programming



	{	H	O	P
{	0	1	2	3
S	1	1 (i)	2	3
O	2	2	1 (ii)	2
P	3	3	2	1 (iii)
A	4	4	3	2 (iv)

- i.  $S \rightarrow H$
- ii.  $O = O$
- iii.  $P = P$
- iv. Delete A



# Final Words



- Fill your toolbox
- Study prior work
- Use your time at UU well

