

Shawarma (Shoarma in Dutch)




- We need 3 ingredients: meat, bread and sauce
- For 200 people, so we want a lot
- We consider package deals, but don't know all possible deals (bargaining is possible)
- We want to find the cheapest combination of package deals

Example designed by Paul Bouman



Column Generation

Minimize

dealer				
current amount				
price				
...	\geq	50kg		...
...	\geq	400		...
...	\geq	20l		...

Total: € ...






Column Generation

Minimize

	
40	10
€8,00	€5,00

Total: € 370

1,5kg	0.75kg	\geq	50kg		0
8	8	\geq	400		0,625
0,5l	0l	\geq	20l		6



Column Generation




Minimize

Can we find a new deal with price c such that, if a_b is the amount of bread and a_s is the amount of sauce, we have $c < 0,625 a_b + 6 a_s$?

Total: € 370

I can sell you packages of 2 breads and 0,5 l sauce for €4 (And $0,625 \cdot 2 + 6 \cdot 0,5 > 4$ is valid)



8	≥ 50		0
0,5	≥ 100		0,625
			6

OK !






Column Generation

Minimize

		
18 ² / ₃	21 ¹ / ₃	24
€4,00	€8,00	€5,00

Total: € 365

0	1,5kg	0.75kg	≥	50kg		0,266
2	8	8	≥	400		0,6
0,5l	0,5l	0l	≥	20l		5,6



Col

Can we find a new deal with costs c , amount of meat a_m , amount of bread a_b and amount of sauce a_s , such that $c < 0,266 a_m + 0,6 a_b + 5,6 a_s$?

Minimize



$18 \frac{2}{3}$

€4,00

€8,00

€5,00

I can sell you packages of 0,25 kg of meat and 7 breads for € 3 (and $0,266 \cdot 0,25 + 0,6 \cdot 7 > 3$ is valid)

0,75kg

$\geq 50kg$

0,266



2

8

100



0,6

OK !

0,5l

0,5l



5,6



Column Generation

Minimize

			
20	10	30	0
€3,00	€4,00	€8,00	€5,00

Total: € 340

0,25kg	0	1,5kg	0.75kg	\geq	50kg		1,11
7	2	8	8	\geq	400		0,38
0	0,5l	0,5l	0l	\geq	20l		6,44



Column generation

Do not include all variables (columns), only generate the columns that are necessary

Successful applications:

- Cutting stock
- Personnel rostering
- Crew pairing in airlines (AA)
- Vehicle scheduling for bus companies
- Transportation planning

