

A. Case Study:

The problem loading UPak

UPak is a subsidiary company of a transportation company with LTL.

UPak's customers offer a price in monetary units per cubic meter for the volume of their cargo. The decision to accept or reject an order for transportation is at the discretion of UPak. The number of potential orders is a parameter N of the problem. The prices offered by customers for each cargo are given in the $\text{Price}[N]$ vector, and the volumes of the cargos in cubic meters are given in the $\text{Size}[N]$ vector.

Customers bring their cargos to UPak's terminal station to be loaded onto trailers, the capacity of which is finite. It should be noted that the number of vehicles owned by the company is a parameter T , and the capacities of the vehicles in cubic meters are given in the $\text{Capacities}[T]$ vector. It is emphasized that partial loading of an order is not allowed. In other words, each cargo can be loaded into at most one vehicle.

The management of UPak wants to automate the process of selecting and assigning those orders to the available vehicles in a way that maximizes its profits. For this purpose, you are called upon to develop an Integer Programming model and implement it using the Python programming language and the Pyomo library.

For the case study described above you should:

1. Develop the analytic form of the model to *describe the variables, constraints, and parameters in the model*.
2. Develop the optimization model in Python/Pyomo. To make it easier for you, UPak provides you with the data of table 1, as well as the corresponding optimal loading plan given in figure 1. Note, however, that ideally your code should be scalable, i.e. able to deal with problems of different dimensions.

Number of Trucks :	2
Number of Items:	10
Capacity of Truck i :	36,36
Profit of item i:	120,93,70,85,125,104,98,130,140,65
Size of item i:	5,11,22,15,7,9,18,14,10,12

Πίνακας 1

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IPython console
Console 1/A

In [128]: runfile('C:/Users/user/Dropbox/teaching/UoM/ODE/MBADS/ΑνάλυσηΑποφάσεωνΚαιΒελτισ
MBADS_cwk_part1.py', wdir='C:/Users/user/Dropbox/teaching/UoM/ODE/MBADS/ΑνάλυσηΑποφάσεωνΚ
The maximum profit is: 7929.0
Orders Assigned in truck 0 :
0 1 5 8
The capacity used in truck 0 is 35

Orders Assigned in truck 1 :
3 4 7
The capacity used in truck 1 is 36

```