

Worksheet Knapsack (Week 8)

You are on your way to grocery shopping using your bike. Thus, you are limited with respect to what you are able to buy and take home; including the available cash but also the space and weight of the products. You are having one backpack to fit all the items. Due to the limitations, you decide to assign a value for each product and run an optimisation before the shopping to increase your overall value for the trip while not exceeding the other restrictions. Follow the case scenarios in the following sub-questions.

Assume that you have one or more bags and have to pick objects represented with a value and weight to put in your bags. One possible goal is to take objects with a maximum value with you while not exceeding the weight limit each bag has; assuming that each object can only be taken one time. Implement this model in AMPL using the following instructions: (Note: put your answers here)

1. **The first activity:** You have n objects with weight and one bag. You want to buy as many objects as possible assuming a weight limit of 3.5kg. Assume the given dataset: shopping_1.dat. Could you predict the answer beforehand?
2. **The second activity:** You decide that the number of items might not be a good target. Change the model to maximise the value instead.
3. **The third activity is:** Assume that you are not having one but 2 bags. How is this changing the implementation? Create a new dataset with the name shopping_2.dat and add required data accordingly. Note that each item can only be bought one time. And each bag is limited by 3.5kg.
4. Would you be able to buy more products if you would have 4 bags but each back can carry only half of the weight (1,75kg)?
5. **The fourth activity is:** How does the answer differ from the previous one if you have 2 bags with 3.5kg limit and a volume limit of 15 VU (Volume Units)? Assume the data for the volume below and create a new data file with the necessary information and name it shopping_3.dat.
6. **The fifth activity is:** How does the model have to be changed if you can take up to 2 of each object rather than 1? How does the solution look like for the Activity 2 and 4? Note: redo these scenarios using this assumption.

Note: There is only one dataset provided, all other files have to be created from scratch.

Files: shopping_1.dat

Data to be added in these activities:

param volume :=

milk 4

butter 1

noodle 2

banana 5

pumpkin 6

washingpowder 10

cheese 7

yoghurt 6
steak 5
fish 5
coffee 9
bread 10;