

# Analytics for a Better World

## Assignment 1

### Case: FeedCalculator

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#### Assignment

You are asked to optimize the feed for the chicken of a specific farmer in Africa. How much of each ingredient should the farmer use such that the total cost **of 1 kg feed** is minimized, and all nutritional requirements are satisfied? Moreover, for each ingredient there is a lower bound and an upper bound on the amount in the diet. Finally, the solution should satisfy so-called ‘combined ingredient rules’, i.e., upper bounds on the sum of specific combinations of ingredients (see under “Data” for more explanation).

This assignment consists of the following steps:

1. Develop a linear optimization model to represent this problem.
2. Implement the model in Python and solve it.
3. Write a report on the optimization model and the optimal solution found.

#### Data

#### ТЕКСТ

The data for this case can be found in the excel file: *Data Set Feedcalculator.xls* on Canvas.

The tab ‘Ingredient Database’ contains information for 53 ingredients. For example the ingredient ‘barley’ (row 2) costs 0.26 dollar per kg (column D). Columns E to BX contain nutritional information. For example: the ingredient ‘barley’ contains 0.4 units of nutrient ‘ca’ (Calcium), which is in column N. The column C indicates whether this ingredient is available for the farmer. Only ingredients with a ‘true’ can be used by the farmer. E.g. ‘barley’ can be used, but ‘copra’ not.

The tab ‘Ingredient Rules’ contains information on rules for the ingredients. Columns B and C contain lower and upper bound of the amount that can be used for 1 kg. For example 1 kg feed can contain at most 0.1 kg ‘barley’. Columns F to N contain information on Combined Ingredient Rules. For example (Column F): 1 kg feed should contain at most 0.17 kg of ‘cotton’, ‘sunflower’, ‘gncake’ and ‘copra’ in total.

The tab ‘Nutrient Rules’ contains information on nutritional restrictions. For example (row 7): 1 kg feed should contain at least 1.4 and at most 2.1 of nutrient ‘na’. If a nutrient is not in this list, it means that there are no restrictions on this nutrient.

#### Companion notebook

For your convenience [this notebook](#) already extracts are relevant data into convenient data structures.

Feel free to copy this notebook and use it as a start for your resolution.

When you are finished, also deliver the notebook, as instructed below as deliverable 2.

**Format report**

The report should be at most 2 pages (lettersize 11 pt), in **English**. You can use Word, and for equations you can use either Word's equation editor, or add a clear picture of the handwritten equations/model. Of course you can also use other word processing software (e.g. LaTeX). The report should have two sections:

- i. Linear optimization model*  
It is important to carefully describe all variables and parameters used.
- ii. Results.*  
This section should contain the optimal solution, and the corresponding objective value.

**Deliverables:** You have to hand in: 1. Report 2. Python code

**Grading:** 50% model, 30% Python code, 20% correctness final solution

**Deadline submission:** October 6, 1.00 PM. Submission via Canvas.