CHAIR OF PRODUCTION MANAGEMENT
Prof. Dr. Raik Stolletz
http://stolletz.bwl.uni-mannheim.de

UNIVERSITY OF MANNHEIM

OPM 662 – Business Analytics : Modeling and Optimization (FSS 2022)

Assignment 1: Linear Models in Python

Due date: March 21st 2022, 23:23 CET

Consider the *Capacitated Lot Sizing Model with multiple products* as defined in the slides from OPM 561 (see upload in Ilias).

The specific data for the parameter considered in this assignment is given in the provided Excel-File *'lotsizing.xlsx'*.

Questions

1. Implementation of the optimization model **(5 P.)**
   a) Create a jupyter-notebook and import the necessary libraries.
   b) Import the data given in the file *'lotsizing.xlsx'* to the jupyter-notebook.
   c) Create a model instance and implement the Capacitated Lot Sizing Model with multiple products.
   d) Solve the model and store the following data in a data frame:
      - Production quantities and inventory levels for each product p and period t
      - Total production quantities over all p for each period t
      - Setup and inventory holding costs for each period t
      - The total relevant costs for each period t
      - The proportional costs for setups compared to the total relevant costs per period
      - Additionally, create a column in which the sum over all periods of all the previous data is given
2. Sensitivity analysis **(1.5 P.)**
   a) Carry out a sensitivity analysis to show the impact of the inventory holding costs on the total costs. Assume that the same inventory holding costs apply to all products.
   b) Visualize the results of your sensitivity analysis using matplotlib.

3. Extension **(1.5 P.)**
   Now assume, that it is not possible to produce product 1 in two consecutive periods (since, e.g., a maintenance period is necessary). State all new additional parameter(s), decision variable(s) and constraint(s). Implement the extended model, explain how your additional constraint(s) work. Solve this problem for the given data as well, and store the data again in another data frame.

Send your complete solutions (Excel files, Python files, plots as pdf) as a zipped archive to **opm662@bwl.uni-mannheim.de**. To obtain full score, your models and results must have proper documentation and it must be possible for us to re-create the results using your Python models.