

Exercise 9

15.11.2022

#1 Finding Pareto-optimal solutions with Excel

Riikka is at an amusement park that offers 2 different rides: Tickets to ride 1 cost 2 € and each ticket lets you take the ride twice. Tickets to ride 2 are for one ride and cost 3 €. Riikka has 20 euros to spend on tickets to ride 1 and ride 2. Each time Riikka takes ride 2, her grandfather cheers for her. Riikka wants to get as many rides and cheers as possible.

- Formulate Riikka's desire to maximize the number of rides and cheers as a MOO problem.
- Use the Excel template provided to solve PO solutions of the MOO problem using weighted sum and weighted max-norm approaches: Execute loops of the approaches manually. On each loop, solve the related (M)ILP problem by using Excel's Solver tool.
- Suppose Riikka states that getting one additional ride is as nice as getting two additional cheers from the grandfather. Study the situation now through MAVT so that the first attribute y_1 is the number of rides and the second attribute y_2 is the number of cheers. Let $y_1^0 = 0$, $y_1^* = 20$, $y_2^0 = 0$, and $y_2^* = 6$. Assume that the attribute-specific value functions are linear. What is the best strategy for buying the tickets?
- Formulate the weighted max-norm approach from part b) as a mixed integer linear problem of the form

$$\begin{aligned} & \min c^T x \\ & \text{such that } Ax \leq b \\ & \text{where } x = \begin{bmatrix} x_1 \\ x_2 \\ \Delta \end{bmatrix}. \end{aligned}$$