Optimization Models in Finance
(Prof. Andrzej Ruszczyński)

ASSIGNMENT 6 *(due Tuesday, October 29, 2019)*

Problem 1
Use duality to solve the following nonlinear programming problem:

$$\min \sum_{j=1}^{n} c_j (x_j)^2$$

$$\sum_{j=1}^{n} a_j x_j = 1,$$

$$0 \leq x_j \leq u_j, \ j = 1, \ldots, n,$$

where $c_j > 0$, $a_j > 0$ and $u_j > 0$, for all $j = 1, \ldots, n$.

Problem 2
You have collected data on monthly return rates of 10 securities, as shown in the attached spreadsheet.

(a) Estimate the expected returns and the covariance matrix of the returns.

(b) Determine the mean—variance efficient frontier, with shorting allowed. Describe this frontier employing the Two-Fund Theorem. Use the minimum variance portfolio as one of the funds involved.

(c) Analyze the efficient frontier (by calculating 10 points on each of them) for the cases when shorting is not allowed. Compare with case b).