AALTO UNIVERSITY
Systems analysis laboratory

Mat-2.4136 Special Topics in Decision Making: Fuzzy Sets
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Exercise 2: Fuzzy optimization and relations

More exercises will follow

1. You are in a board which decides how much money assign to different projects. The 5 projects received the following scores.

$$\mathbf{p} = (10, 7, 5, 8, 4)$$

the objective function is that of allocating the money to the best projects (maximize $z = 10x_1 + 7x_2 + 5x_3 + 8x_4 + 4x_5$), but with some additional constraints: The amount of money to be given should be less than 1.000.000, but you can use some reserves and it can go up to 1.100.000 in case of particularly good projects. Usually no project should take more than 280.000 of the money, but in special cases this rule can be overcame and the funding grow up to 350.000. Also, no project should get less than 120.000, but also in this case, it can go down to 100.000. Write down a fuzzy optimization problem for the fair allocation of resources and write the linear optimization problem to solve it as a max-min problem.

2. Consider the two relations

$$
R = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\!\!\begin{array}{c} y_1 \quad\ y_2 \\ \left(\begin{array}{cc} 0.7 & 0.5 \\ 0.8 & 0.4 \end{array} \right) \end{array}
\qquad
S = \begin{array}{c} \\ y_1 \\ y_2 \end{array}\!\!\begin{array}{c} z_1 \quad\ z_2 \quad\ z_3 \\ \left(\begin{array}{ccc} 0.9 & 0.6 & 0.2 \\ 0.1 & 0.7 & 0.5 \end{array} \right) \end{array}
\tag{1}
$$

Then calculate $T = R \circ S$ with the $\max - \min$ composition and with the $\max - \Pi$ composition.