Homework 1: Lateral Inhibition

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1   Lateral Inhibition

Let x_1, x_2, x_3 represent how many deciliters of each product A, B or C should be produced.

She can sell product A for 60kr per liter, product B for 70kr per liter and product C for 30kr per liter. This gives the objective function $Z = 6x_1 + 7x_2 + 3x_3$. The objective function says that for every dl of product A sold she will profit 6kr. If she sells 2dl of each product, she will earn $Z = 6*2 + 7*2 + 3*2 = 32$

Since the DTU student has 7 liters of Ethanol and product A uses 1dl, product B 2dl and product C 1dl, we have the constraint: $x_1 + 2x_2 + x_3 \leq 70$

She has 21 liters of apple juice. Product A uses 2dl, product B uses 2dl and product C uses 3dl, which gives the constraint $2x_1 + 2x_2 + 3x_3 \leq 210$

Lastly, she has 20 liters of Coca-Cola. Product A uses 3dl, product B uses 1dl and product C uses 1dl, which gives the constraint $3x_1 + x_2 + x3 \leq 200$

The constraints and objective function gives the following LP:

$$
\begin{aligned}
\text{Maximize} \quad & Z = 6x_1 + 7x_2 + 3x_3 \\
\text{Subject to} \quad & x_1 + 2x_2 + x_3 \leq 70 \\
& 2x_1 + 2x_2 + 3x_3 \leq 210 \\
& 3x_1 + x_2 + x_3 \leq 200 \\
& x_1, x_2, x_3 \geq 0
\end{aligned}
$$

It is informed that for the optimal solution, she only makes product A and product B and that she does not use up all the apple juice. There are 3 constraints and so there must be 3 basic variables. Based on this information, it can be concluded that x_1, x_2 (product A and B) as well as the slack variable for the second constraint (apple juice) are basic variables. This is because x_1 and x_2 are non-zero in the solution and that the apple juice was not used up (the slack variable is non-zero)

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