Ex 2 - modelling - afternoon

$x_i \geq 0 \quad i = 1 \dots 4$ qt of raw material M_i

Base model

$$\max \quad 130 \underbrace{\sum_{i=1}^{4} x_i}_{\text{total qt of product (ton)}} - \underbrace{(70x_1 + 100x_2 + 80x_3 + 50x_4)}_{\text{total cost for buying raw material}}$$

$$\underbrace{3x_1 + 9x_2 + 12x_3 + 8x_4}_{\text{total qt of lead}} \leq 6 \left(\sum_{i=1}^{4} x_i\right)$$

at most 6 gr of lead per ton in final product

$$0 \leq x_1 \leq 1000$$
$$0 \leq x_2 \leq 2500$$
$$0 \leq x_3 \leq 7000$$
$$0 \leq x_4 \leq 2000$$

We introduce binary variables

$y_i \in \{0, 1\} \quad i = 1 \dots 4 \qquad y_i = 1 \Rightarrow$ raw material M_i is bought

coherence constraint:

$$x_1 \leq 1000 y_1$$
$$x_2 \leq 2500 y_2$$
$$x_3 \leq 7000 y_3$$
$$x_4 \leq 2000 y_4$$

[As for morning also $x_i \leq M y_i$ is valid, M large enough, but half points. (if M is not specified)]

$x_i \geq 30 y_i \quad i = 1 \dots 4$ at least 30 tons must be bought (if I buy)

$\sum_{i=1}^{4} y_i \leq 3$ at most 3 must be used (equiv. to not all must be used)