Exercise session 7

16/12

① Find an optimal solution to the following equality-constrained problem

$$(NLP_=) \quad \min \; x_3$$
$$\text{s.t.} \quad x_1^2 + x_2^2 + x_3^2 = 6$$
$$x_1 + x_2 + x_3 = 4$$

Motivate global optimality

Hint: Show that $\mathcal{F}$ is compact

② Solve $\quad (NLP_\leq) \quad \min \; cx_1 + x_2$

$$\text{s.t.} \quad (x_1-1)^2 + (x_2-1)^2 \leq 9$$
$$(x_1-1)^2 + (x_2+1)^2 \leq 9$$
$$(x_1+1)^2 + (x_2-1)^2 \leq 9$$
$$(x_1+1)^2 + (x_2+1)^2 \leq 9$$

Motivate global optimality. Use $c=1$ and $c=0$

③ Observe the following $(NLP_\leq)$

$$(NLP_\leq) \quad \min \; x_1$$
$$\text{s.t.} \quad x_2 - x_1^3 \leq 0$$
$$-x_2 - x_1^3 \leq 0$$

a) Illustrate the feasible region and draw level curves of the objective function. Note that $\hat{x} = (0\ 0)^T$ is a global minimizer

b) Show that $\hat{x}$ <u>does not</u> satisfy the KKT-conditions for $(NLP_\leq)$ Explain why.