

• $\tilde{x} = f(x, u)$
 $\dot{x} = Ax + Bu$

translate \rightarrow

$x_{k+1} = \tilde{f}(x_k, u_k)$
 $x_{k+1} = \tilde{A} x_k + \tilde{B} u_k$
 + stability

\rightarrow discrete-time systems
 \rightarrow the Brillouin zone

• buying a car

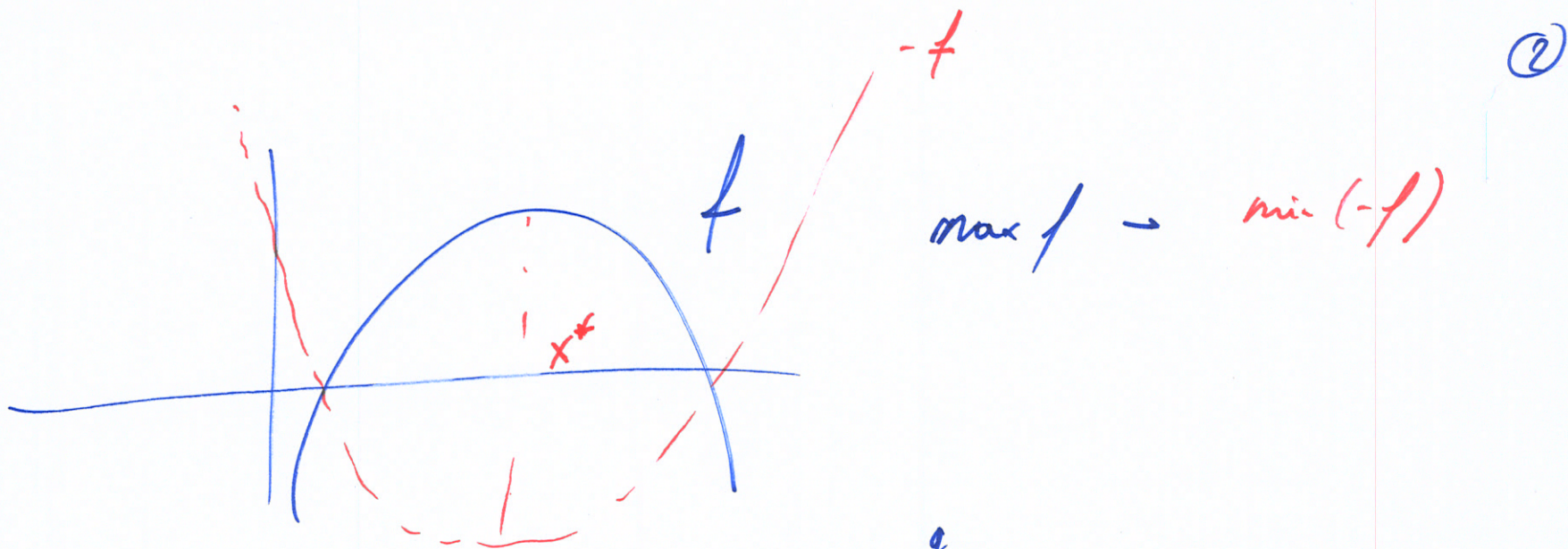
objectives :
 + low cost
 fuel/energy efficiency
 good mileage
 speed
 comfy
 robustness (lifetime)

} min
 } max

Constraints :
 $1000000 \leq \text{price} \leq 5000000 \text{ EUR}$
 # seats ≥ 2
 availability \rightarrow delivery time ≤ 4 weeks
 bagging space $\geq 10 \text{ m}^3$

min $f(x)$
 $x \in \mathbb{R}^n$

$g(x) \leq 0$
 $h(x) = 0$



$$\underline{l} \leq \rho \leq \bar{u}$$

$$\underline{l} \leq \rho$$

$$\rho \leq \bar{u}$$

\rightarrow

$$g \begin{bmatrix} \underline{l} - \rho \\ \rho - \bar{u} \end{bmatrix} \leq 0$$

$$x = \rho$$

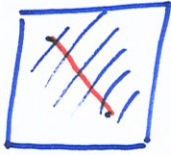
$$g(\rho) = \begin{bmatrix} \underline{l} - \rho \\ \rho - \bar{u} \end{bmatrix}$$

$$\Rightarrow g(\rho) \leq 0$$

$$\# \text{ roots} = 4$$

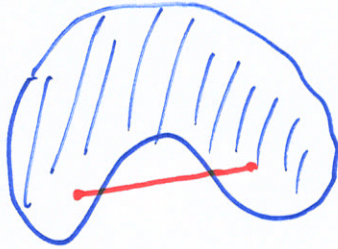
$$\rightarrow \underbrace{\# \text{ roots} - 4}_{h} = 0$$

Convex



③

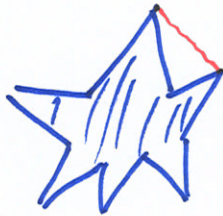
Non Convex



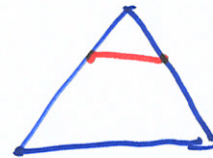
Convex / non Convex



not convex



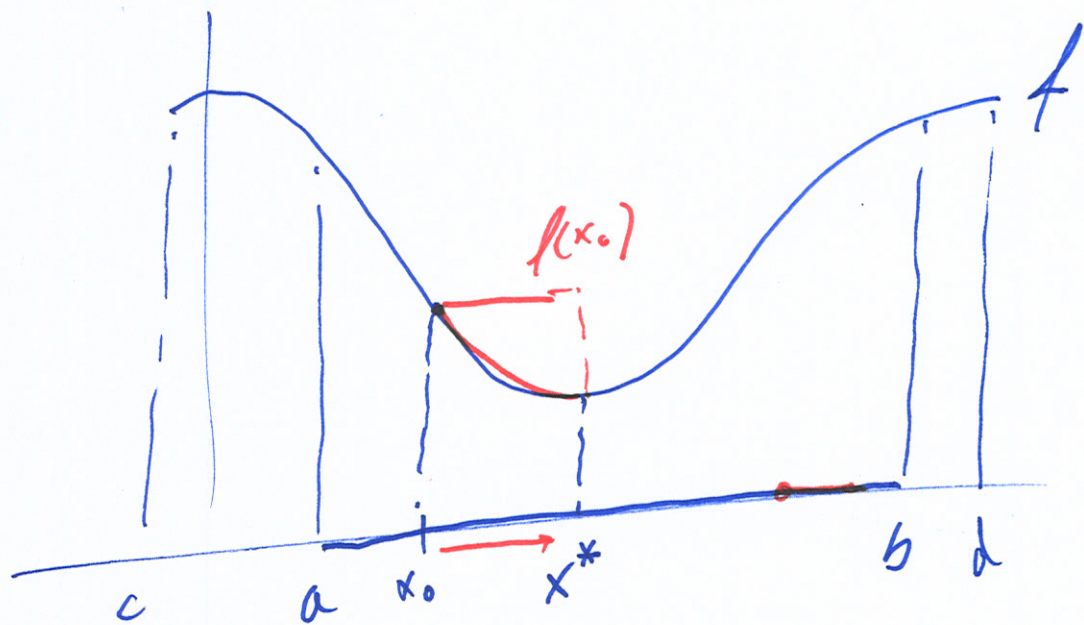
not convex



not convex
(interior is
not considered
here, only
3 edges)

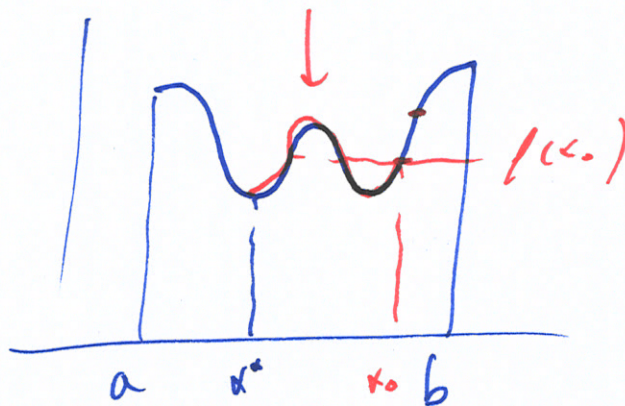
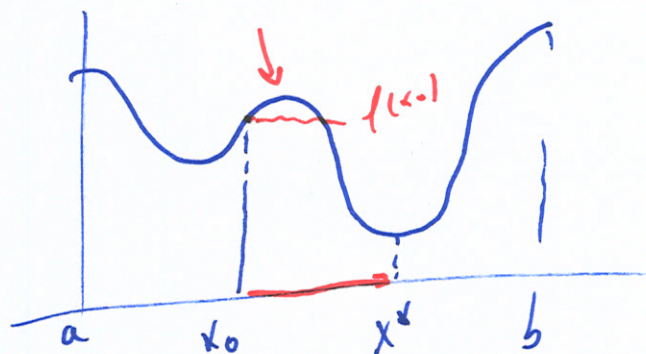
unimodal

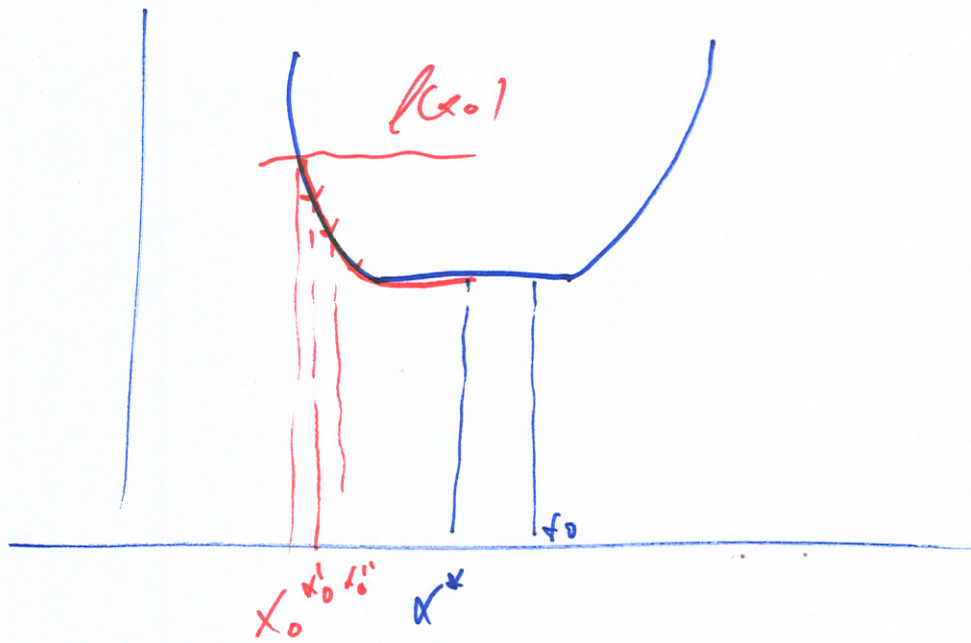
9



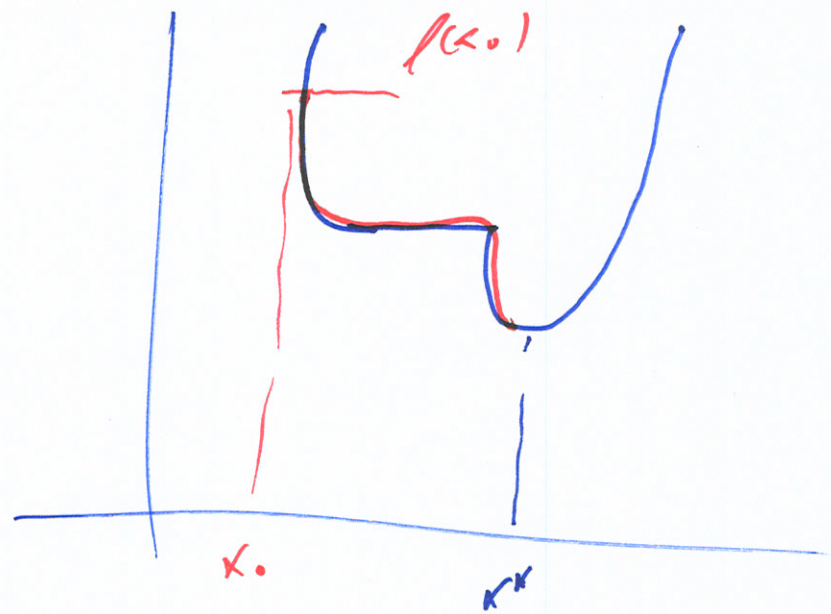
dom $f = [a, b]$
 \rightarrow convex

not unimodal



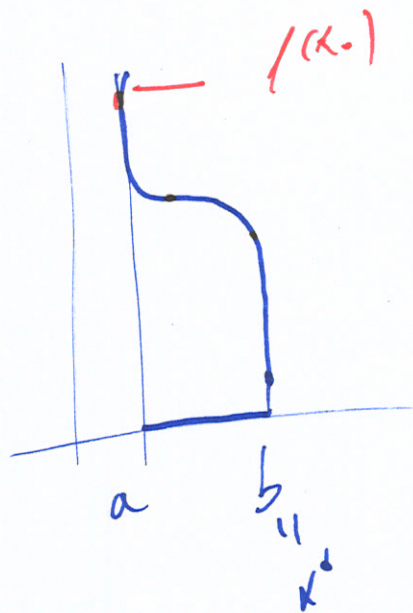


unimodal

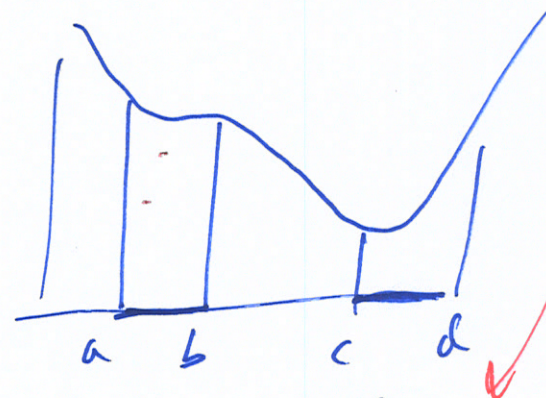


unimodal

for $f = [a, b] \cup [c, d]$
not convex



unimodal



not unimodal