Given an optimization problem

$$\begin{aligned} \min \quad & f_0(x) \qquad (\text{w.r.t. } K) \\ \text{subject to} \quad & f_i(x) \le 0 \qquad i = 1, \dots, m \\ & h_i(x) = 0 \qquad i = 1, \dots, p \end{aligned}$$

$$\mathcal{D} = \bigcap_{i=0}^{m} \operatorname{dom} f_i \cap \bigcap_{i=1}^{p} h_i(x)$$

consider the set of achievable objective values:

$$\mathcal{O} = \{ f_0(x) \mid x \in \mathcal{D},\ f_i(x) \le 0 \ \forall i = 1, \dots, m \\ h_i(x) = 0 \ \forall i = 1, \dots, p \}$$

A point x^* is optimal if $f_0(x^*)$ is the minimum element of $\mathcal{O}$.

A point x^* is Pareto optimal if $f_0(x^*)$ is a minimal element of $\mathcal{O}$.

Another framing: let F be the set of feasible points for our problem

$$\mathcal{F} = \{ x \in \mathcal{D} \mid f_i(x) \le 0,\ i = 1, \dots, m, \\ h_i(x) = 0,\ i = 1, \dots, p \}$$

A point $x^* \in \mathcal{F}$ is <u>optimal</u> if

$$f_0(x^*) \preceq_K f_0(y) \quad \forall\ y \in \mathcal{F}.$$

A point $x^* \in \mathcal{F}$ is <u>Pareto optimal</u> if

$$f_0(y) \preceq_K f_0(x^*) \Rightarrow f_0(y) = f_0(x^*).$$