

Multi-Criteria Optimization

Exercise 1: Concepts in Multi-Criteria Optimization

Analyse a Multi-Objective Optimization problem with the following six solutions in objective space:

$$\mathbf{f}^{(1)} = (10, 5)$$

$$\mathbf{f}^{(2)} = (7, 8)$$

$$\mathbf{f}^{(3)} = (4, 6)$$

$$\mathbf{f}^{(4)} = (6, 4)$$

$$\mathbf{f}^{(5)} = (9, 3)$$

$$\mathbf{f}^{(6)} = (3, 7)$$

- (a) Determine which of these solutions are Pareto optimal.
- (b) For the Pareto optimal solutions, sketch the objective space and indicate the Pareto front.
- (c) Assume a reference point $R = (15, 15)$. Calculate the dominated hypervolume of the Pareto optimal points.
- (d) Perform non-dominated sorting.
- (e) Compute the crowding distance of the point with the solution $\mathbf{f}^{(3)}$.
- (f) Compute the hypervolume contribution of the point with the solution $\mathbf{f}^{(5)}$. Again, assume a reference point $R = (15, 15)$.

Note: We want to minimize both objectives f_1, f_2 .