6. Exercise Sheet

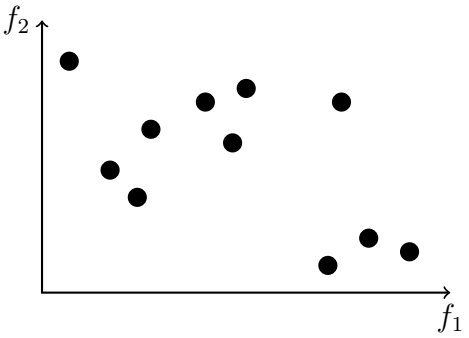
Exercise 1 Methods for solving MOPs

a) Describe the basic structure of one a priori and one a posteriori method for solving MOPs. Name their advantages and disadvantages.

Exercise 2 Ranking method

a) Rank all the particles in terms of the number of superior individuals by which they are dominated when both features need to be minimized.

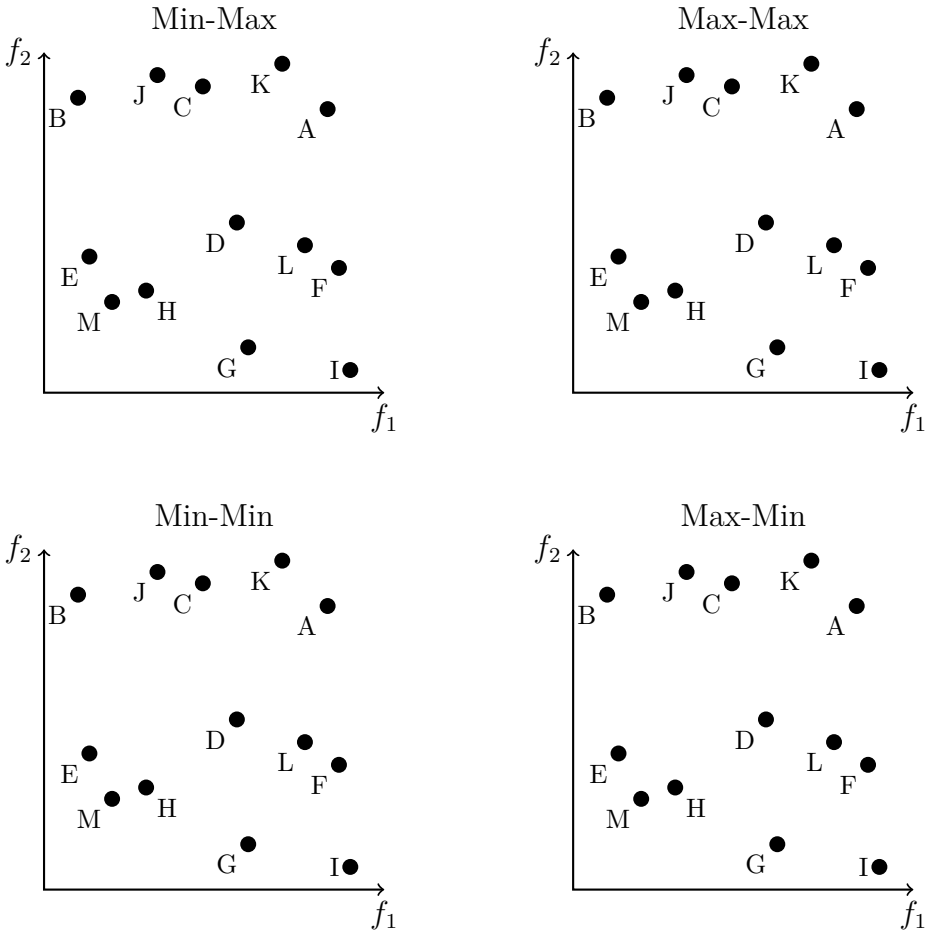
b) This measure in the first subtask does only optimize the convergence of the pareto-front. Name and describe an alternative method, which takes the divergence of solutions into account.



See the next two pages for the remaining tasks!

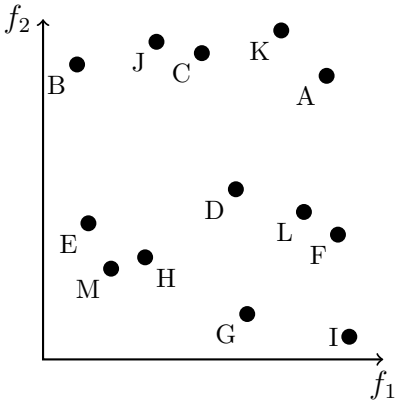
Exercise 3 Pareto-Fronts and NSGA-II

a) Determine the Pareto-Front for all combinations of minimization and maximization of features f_1 and f_2. You can just mark the individuals of the Pareto-Front in each of the following plots.



b) In the following set of solutions shown in the objective space (assuming minimization of both objectives), identify the different non-dominated fronts of solutions by using the concept of the NSGA-II algorithm.

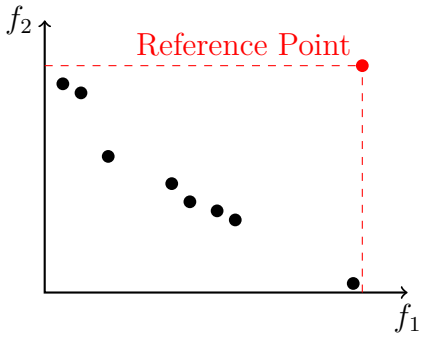
c) Which solutions will be selected for the next population using crowding distance if we have a population size of 8?



Exercise 4 Marginal Hypervolume

a) Which one of the following solutions has the largest marginal HV?

b) Which one of the following solutions has the smallest marginal HV?



x	y
0.2	2.3
0.4	2.2
0.7	1.5
1.4	1.2
1.6	1.0
1.9	0.9
2.1	0.8
3.4	0.1
3.5	2.5

Exercise 5 Hypervolume

Suppose we are comparing two sets of non-dominated points A and B with each other using their hypervolume.

a) For which of the following scenarios can the following inequality be true: HV(A) < HV(B)? Remember that the hypervolume needs to be computed on all points (A=•, B = ■).

b) How does the position of the reference point influence the comparison of A and B?