Assignment 10 Interactive Methods

Review the information about interactive methods and answer the following questions.

- Present three possible forms of interaction with the decision maker (DM).

❖ Choose one among several alternatives:

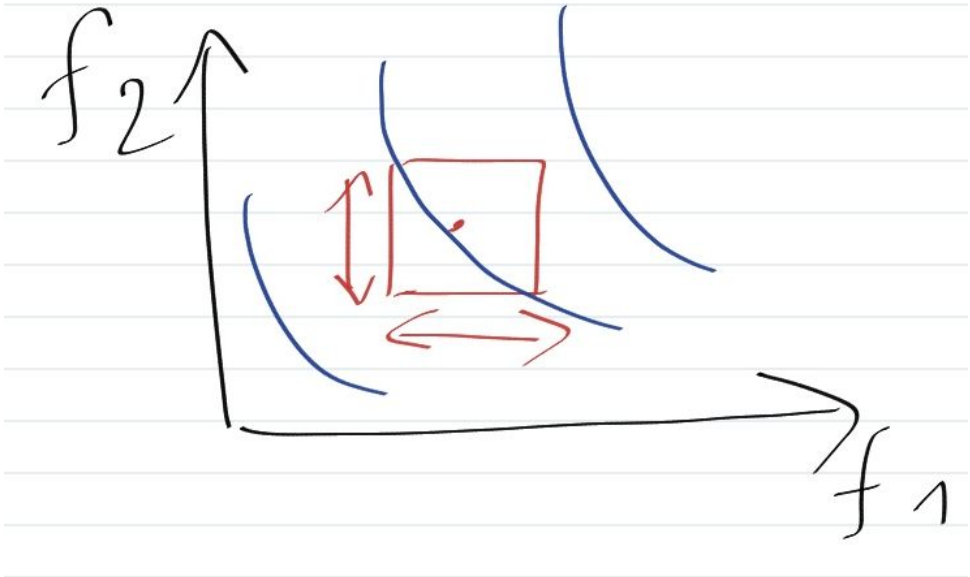
DM is given a set of solutions and based on which are interesting and satisfactory to provide optimal results are provided.

❖ Pairwise comparison

DM performs a one-on-one comparison among the available solutions to provide the optimal one.

❖ Reference-point method

Desirable values forming a reference point or value ranges for objective functions.



Problem: Pareto front is not known.

- What characteristics should a good interactive method possess with respect to the interaction with the DM?

1) Only a few of the PO solutions which are to the **interest** of the DM is generated.
2) DM is not **overloaded** with information
3) Ensures that DM can **learn** thus by specifying and correcting the preferences as the selection process continues.
4) Enables DM to have more **confidence** in the final solution chosen.

- We want to solve the following bi-objective optimization problem:

$$\min(x_1 + 2x_2 + 3x_3, -2x_1 - 3x_3 + 6)$$
$$s.t. x_1, x_2, x_3 \in \{0, 1\}$$

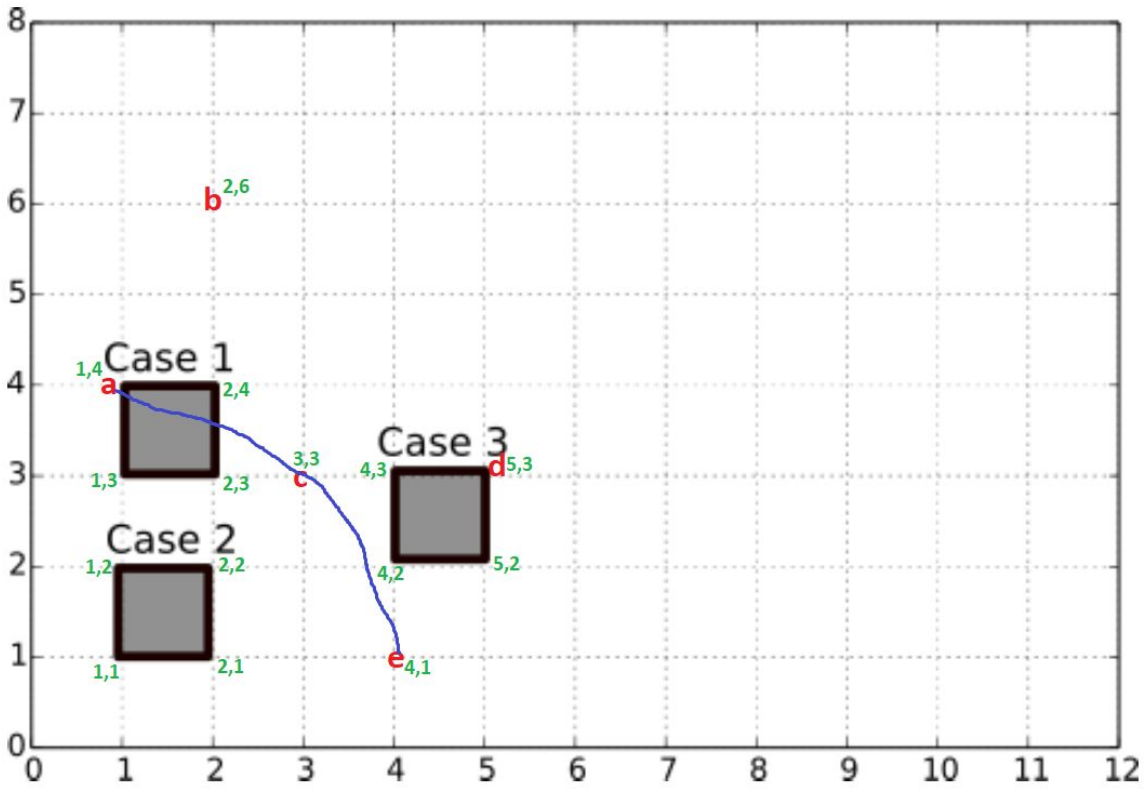
For which we use a binary encoding with three bits, and a standard deterministic 1-bit neighborhood. In a first iteration, the solutions $\vec{a} = (1,0,0)$, $\vec{b} = (0,1,0)$, $\vec{c} = (0,0,1)$, $\vec{d} = (0,1,1)$ and $\vec{e} = (1,0,1)$ were obtained.
Then, only the two most relevant between these solutions should be presented to the DM. For deciding which ones, the DM provides a rectangular region in the objective space that he/she considers of higher interest. What solutions would you present in each of the following cases?

Definition: Domination

$\vec{x}_1 \in S$ is said to dominate $\vec{x}_2 \in S$ iff

1. $f_i(\vec{x}_1) \leq f_i(\vec{x}_2)$ for all $i = 1, \dots, m$
2. $f_j(\vec{x}_1) < f_j(\vec{x}_2)$ for at least one j.

solutions	a	b	c	d	e
a	NA	dom	ndom	ndom	ndom
b	ndom	NA	ndom	ndom	ndom
c	ndom	ndom	NA	ndom	ndom
d	ndom	ndom	ndom	NA	ndom
e	ndom	ndom	ndom	dom	NA



Case 1: a
Case 2: d
Case 3: No solutions

- For the same problem, each of the five solutions are updated by taking a solution in their neighborhood or keeping the current solution. This is done based on the region provided by the DM, so the selected solution is the best possible according to the DM preferences. Which new five solutions would you obtain for each of the previous cases?
  Note: When selecting the best solution in the neighborhood, a non-dominated solution (in the neighborhood) is always preferred, and the closeness to the region is used as a second factor.

Case 1: a, c
Case 2: d (c or e)
Case 3: No solutions