INF3490/INF4490 Exercises Solutions - Week 3

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$\mathbb{P}$ marks the programming exercises, we strongly recommend using the python programming language for these. Exercises may be added/changed after publishing.
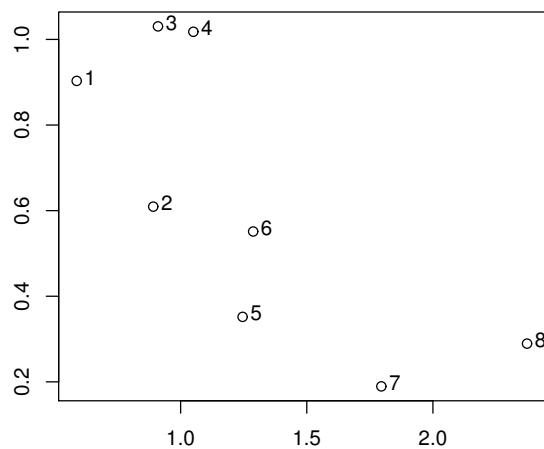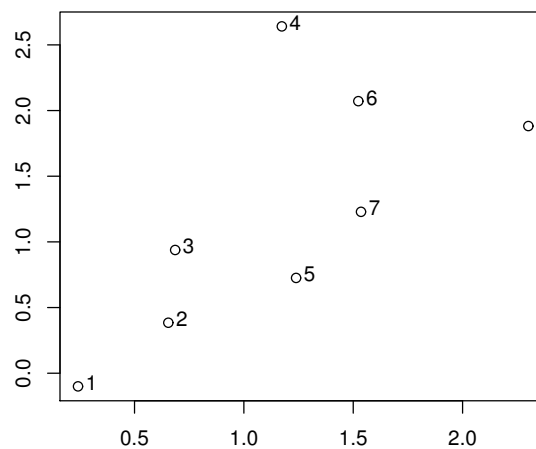
1 Pareto Optimality

Figure 1: a

Figure 2: b

For figure a and b above, find the Pareto optimal set when

- Minimizing both f_1 and f_2

- Minimizing f_1, maximizing f_2

- Maximizing f_1, minimizing f_2

- Maximizing both f_1 and f_2

Answer:

	a	b
min f_1, min f_2	{1,2,5,7}	{1}
min f_1, max f_2	{1,3}	{1,2,3,4}
max f_1, min f_2	{7,8}	{1,2,5,7,8}
max f_1, max f_2	{3,4,6,8}	{4,6,8}

Table 1:

2 Weighted sum

In figures a and b, what would be the maximum point when using weighted sum:

- $w_1 = 1$, $w_2 = 1$

- $w_1 = -1$, $w_2 = 1$

Answer:

$w_1 = 1$	$w_2 = 1$	$\Rightarrow$	$\max a = 8$	$\max b = 8$
$w_1 = -1$	$w_2 = 1$	$\Rightarrow$	$\max a = 1$	$\max b = 4$

3   Hybrid Algorithm

Why can hybrid algorithms make it harder to maintain diversity?

Answer:

Hybrid initialization can lead to very uneven initial coverage of the search space, which might hamper the search. Hybrid crossover and mutation, as well as (Lamarckian) local search before evaluation will lead solutions towards clusters near (local) optima.

4   Measuring algorithm performance

Why is it usually better to use the number of fitness function evaluations as a time measure, rather than the number of generations, or the amount of CPU time spent?

Answer:

Actual CPU time will change based on the resources available on the machine when running the algorithm. This means that the hardware and running software (circumstances) will affect the measured time. The evaluation is usually the most computationally intensive part of the algorithm, and is invariant across optimization algorithms since it is strictly problem dependent. To improve performance we want to minimize the amount of evaluations, and thus using it as a measurement makes sense. Number of evaluations is only dependent on the algorithm, not on circumstances.

Contact and Github

Corrections of grammar, language, notation or suggestions for improving this material are appreciated. E-mail me at **olehelg@uio.no** or use **GitHub** to submit an issue or create a pull request. The **GitHub repository** contains all source code for assignments, exercises, solutions, examples etc. As many people have been involved with writing and updating the course material, they are not all listed as authors here. For a more complete list of authors and contributors see the **README**.