Potential Exam Questions

Introduction to Optimization lecture
at CentraleSupélec / ESSEC Business School

Dimo Brockhoff

`firstname.lastname@inria.fr`

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Abstract

Below, you find a few questions that shall give you an idea of expected difficulties in the upcoming exam for the lecture "Introduction to Optimization" at CentraleSupelec/ESSEC. Please note that there is no guarantee that all final questions are related to the ones below or that they will be all of similar difficulty than the questions provided here.

You can expect that the "rather simple" questions are worth around 4 points and the "less simple" questions about 12 points with a total of 180 points for a 3-hours exam.

1 Rather Simple

- Mention two crossover operators on bitstrings and explain in 2-3 sentences how they work.

- What is the weight of an optimal minimum spanning tree in the following graph? Argue why the given weight is optimal.

- Compute the shortest path from node u to node v in the following graph and argue why this is the shortest path.

- We consider the 2-dimensional function $f(x) = 9x_1^2 + 3x_2^2$. Which of the following plots correspond to the level sets of the function?

- Compute the gradient of the function $f(x) = \frac{1}{2}\left(10^3 x_1 + \sum_{i=2}^{n} x_i^2\right)$.

- Compute the Hessian of the function $f(x) = \frac{1}{2}\left(10^3 x_1 + \sum_{i=2}^{n} x_i^2\right)$.

2 Less Simple

- The following trees are supposed to showcase the working principles of a branch and bound algorithm. Unfortunately, several errors have been introduced when creating the example. What is the first erroneous time step, for which the example cannot be produced by a branch and bound algorithm anymore?

- Given a (small) set of objective functions and a (small) set of algorithms that have been run on the given functions, match given concrete convergence graphs without labels with the algorithm names.