Exercise 4: Semi-Analytical Optimization Tasks

Summer Term 2024

Review: So far, we have considered two different types of optimization problems. These were:

At first glance, the optimization problems of this exercise look like analytical problems, **but** ...

1.

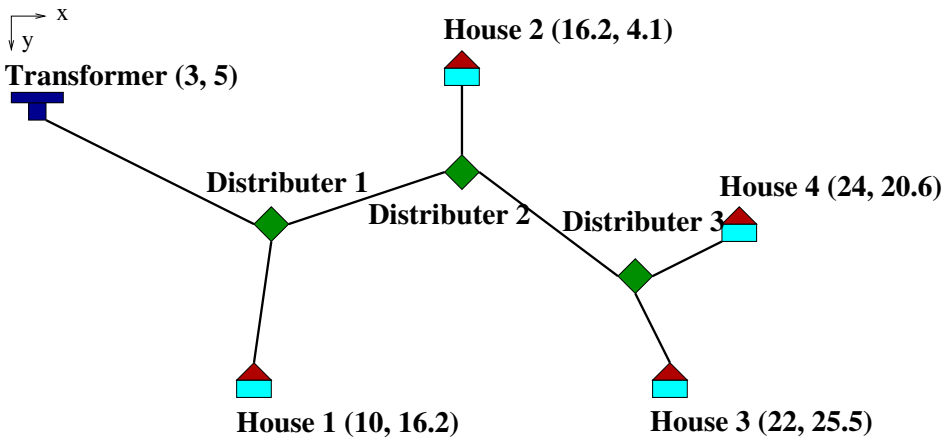
2.

To Do: Please, try to find the optima of the following applications, which are all given in an analytical form. Please answer the following questions for every task.

1. What are the difficulties?
2. How would you try to proceed?

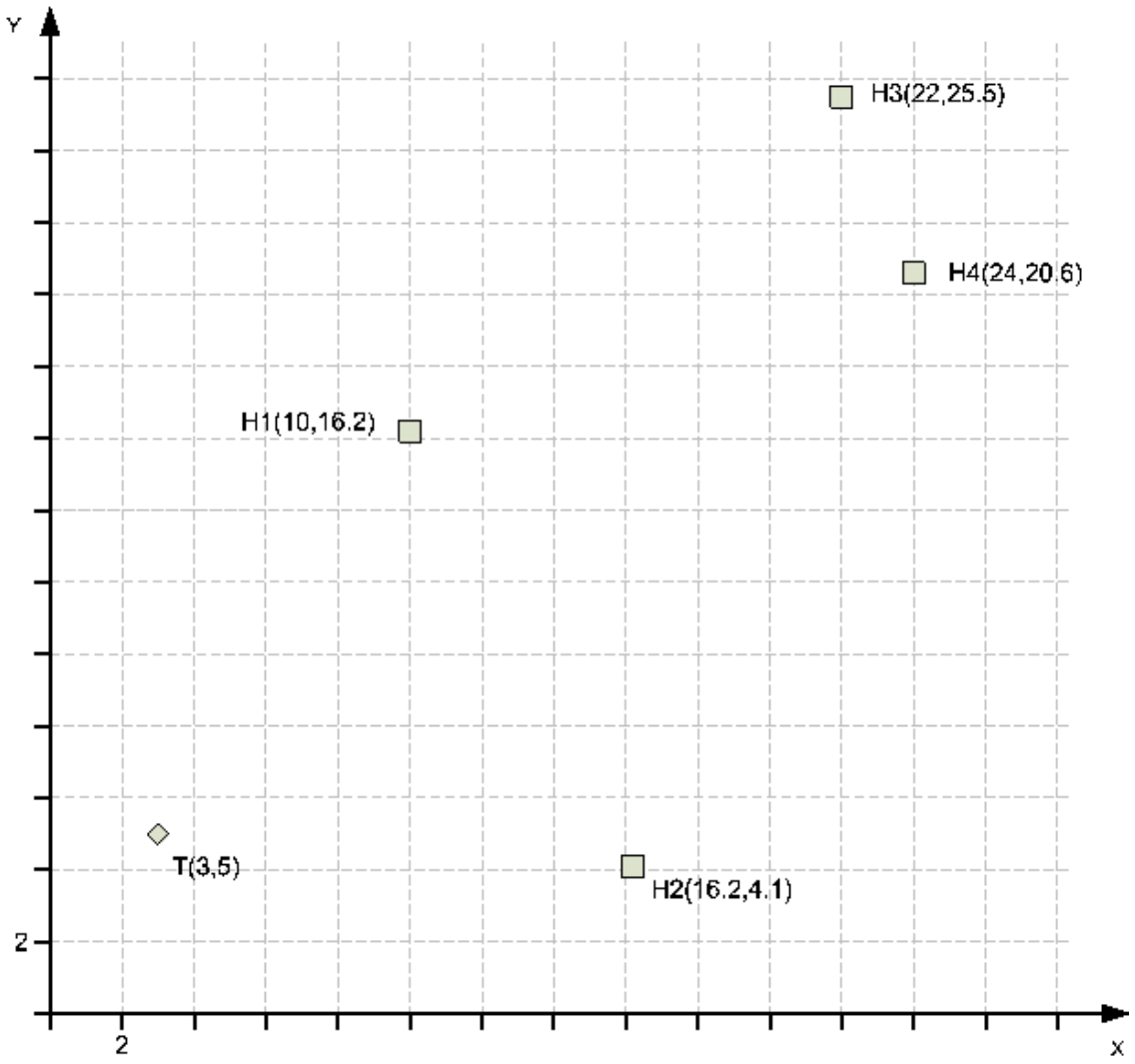
Applications: Please consider the following problems:

1. $f(x) = x^2 + \sin(x)$
2. The figure presented below depicts an electrical power supply network consisting of a transformer (T), four houses ($H^{1..4}$), and three distribution nodes ($D^{1..3}$). The positions, i.e., the x and y coordinates, of the transformer and the houses are fixed and can be found in the figure. The positions of the distribution nodes, however, are flexible. The goal is to optimize the network such that its total length is minimal.



According to Pythagoras, the distance l_{pq} between two points p and q is given as: $l_{pq} = \sqrt{(p_x - q_x)^2 + (p_y - q_y)^2}$. What is the total length L of the entire network? Please, write down its formula: $L(D^1_x, D^1_y, D^2_x, D^2_y, D^3_x, D^3_y)$ of the entire network.

Questions: Can you solve the equation for its six parameters? What is the problem?



Have fun, Theo and Ralf.