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# Lab 2 – Design of Experiments

Short course on Statistical modelling for optimization

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The first half of this lab session is dedicated to designing the best possible DoE. In the second one, we will run the actual experiments.

## 1 Design of experiments

The aim of this section is to define a DoE of 40 points over  $(0, 1)^4$  that shows good space filling properties and good projection properties. Some useful functions (such as `discrepancy`, `minimax`, `maximin`, `IMSE`) are provided in the file `lab2.py`. The file `SobolSequence.py` will also be of particular interest to generate low discrepancy sequences.

**Q1.** Write a function that implements a Latin Hypercube Design. The function should take as parameters the number of points  $n$  and the dimension  $d$ . It should return a `np.array` with shape  $(n, d)$ .

**Q2.** Write a function that returns a Centroidal Voronoi Tessellation. You may use a k-means or a McQueen algorithm. The inputs and outputs should be as in Q1.

**Q3.** Generate various DoE using the functions you just wrote (you may also consider `SobolSequence`).

**Q4.** Choose your favorite DoE using the various space filling criteria. Do not forget to test the projections on some variables. Justify your choice in the report.

## 2 Running the experiments

**Step 1.** Save your best design in a file (csv for example).

**Step 2.** Run the experiments with the simulator and save the outputs in a file.