Scientific Visualization Exercise 2

Problem 1

Problem 2

1 height field of a country

- Data domain: Local influence
- Data type: Scalar
- Range of values: Nominal

2 air flow around a wing of a plane

- Data domain: Influence of samples
- Data type: Tensor
- Range of values: Ordinal XXX

3 temperature in a lecture room

- Data domain: Global influence
- Data type: Vector
- Range of values: Metric

4 dataset given in Problem 5 of Exercise Sheet 1

- Data domain: Global influence
- Data type: Scalar
- Range of values: Nominal

5 the data described in Problem 1 of this exercise sheet

- Data domain: Influence of samples
- Data type: Multivariate
- Range of values: Nominal

6 position of a car on a parking lot which has three sectors (A, B, C) with 20 parking spots each; the parking spots are numbered from 1 to 20 in each sector separately

- Data domain: Point influence
- Data type: Vector
- Range of values: Nominal

7 positions of gas stations on along single road

- Data domain: Point influence
- Data type: Vector
- Range of values: Ordinal

Problem 3

a) Curvilinear (irregular) grid:
Advantages:

- Regular topology
- Topology still implicit
- Much more flexible alternative to model arbitrarily shaped objects

Disadvantages:

- Irregular spacing between grid nodes
- Nonlinear scaling of positions along either axis
- Node positions have to be stored explicitly
- Cells are rectangular
- Geometric structure might result in concave grids

b) Unstructured grid:
Advantages:

- Can be adapted to local features
- More efficient than direct approach in terms of memory requirements

Disadvantages:

- Storage space, redundancy
- Additionally store the data values
- Still have to do global search to find local information

c) Multi-uniform grid:
Advantages:

- Spacing between grid nodes is constant in each dimension
- Necessarily convex
- Focus on specific areas to avoid unnecessary detail in other areas
- Finter grid for regions of interest

Disadvantages:

- Difficulties in the boundary region (e.g. with interpolation)
- Sorting of grid elements and point location more difficult

Problem 4

- source code **problem4.py**, visualisation stored in **problem4.pdf**
- Based on the computed measures and the visualizations:
  - All datasets have the same *X mean*, *X variance* value and their Y variances are approximately the same. So the datasets should possibly have their visualizations somehow in common. However, based on their visualizations, only 2 datasets seem to be close to each other based on the value of their variance, as dataset **2** represents actually a curve - a quadratic function and dataset **1** seems to have data points that represent a linear function. Dataset **4** has one data point that stands quite far from the others as well as the mean point.
  - Dataset **3** indeed represents a linear function, when without data point at $x = 14$. However, as the other data points correlate so well between their x- and y-values, the correlation is not so large, in comparison with the *correlation* values of the other datasets.

Problem 5

a) The dataset has 262144 points and 250047 cells. Its bounds are Xmin,Xmax: (-2, 2), Ymin,Ymax: (-2, 2), Zmin,Zmax: (-2, 2) and extent is (0, 63, 0, 63, 0, 63).

b,c,d,e) see source code **exercise2.py**

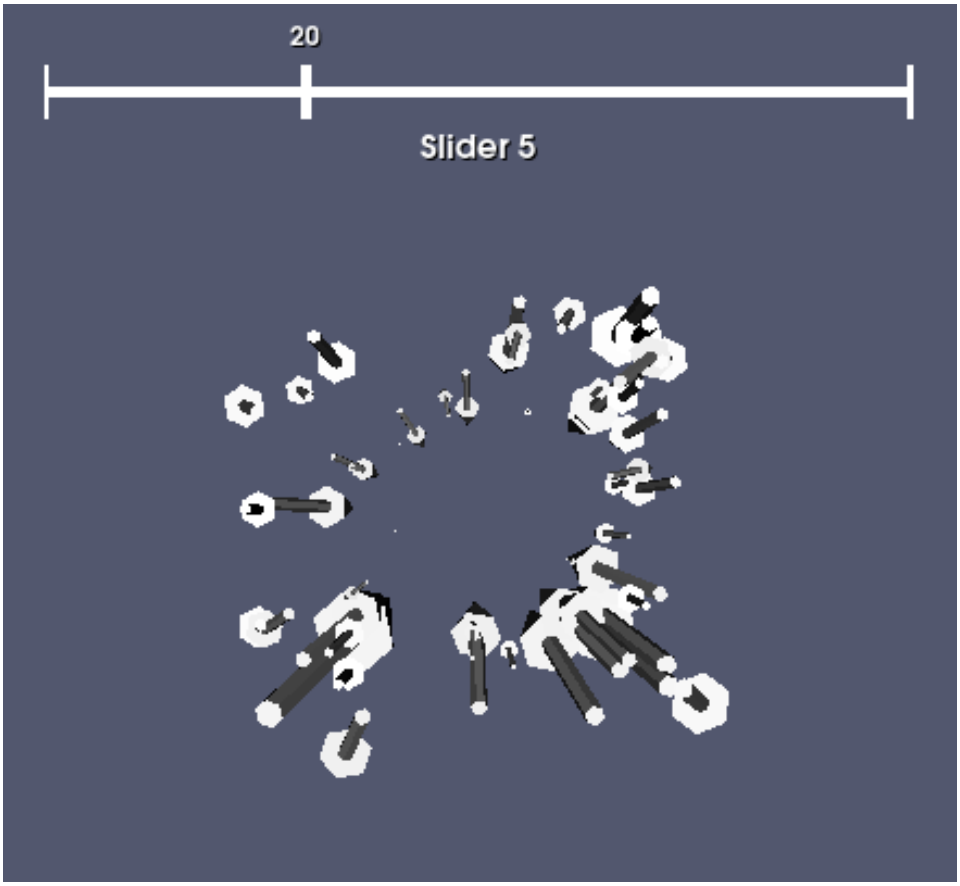

Figure 1: End version after changing in source code