Disclaimer: Below you find some example questions, which should help you prepare for the exam. Note, however, the actual questions at the exam can be very different and can cover all material presented in the lecture!

Visualization Pipeline

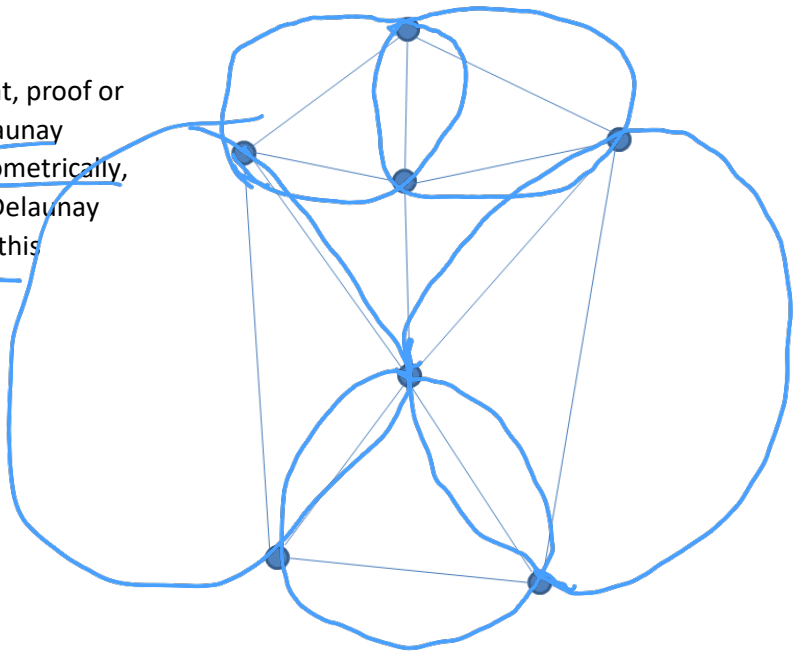
a) Explain the visualization pipeline. What are the four stages?
b) Explain the data acquisition stage. What are three general cases?
c) Explain the filtering/enhancement stage. Give at least two examples.
d) Explain the visualization mapping stage. Give at least two examples.
e) In which stage of the visualization pipeline happens resampling to a regular grid?
f) In which stage of the visualization pipeline are the viewpoint and lighting parameters specified?
g) In which stage of the visualization pipeline happen lighting and shading?
h) In which stage of the visualization pipeline are colors assigned to every voxel?
i) In which stage of the visualization pipeline happen smoothing and noise suppression?

Data Representation

a) Discuss independent vs. dependent variables in data. Give at least two examples each.
b) What are the independent and dependent variables in a 3D spatial curve $\phi : \mathbb{R} \rightarrow \mathbb{R}^3$
c) What are the independent and dependent variables in a 3D vector field?
d) What type of attribute are the following: categorical, ordinal, or quantitative?
    a. Type of cheese (e.g., Swiss, Brie)
    b. Tire pressure (e.g., 2.3 bar, 2.5 bar)
    c. First name (e.g., Alice, Bob)
    d. Unemployment rate (e.g., 6%, 10%)
    e. T-Shirt sizes (e.g., medium, large)
e) Draw an illustration of a Cartesian grid. Describe how such a grid is different from a regular grid? Which information needs to be specified explicitly for such a grid?
f) What is a curvilinear grid? How is it characterized? How is it different from an unstructured grid? Which information needs to be specified explicitly for such a grid?

Data Interpolation

a) For the triangulation shown on the right, proof or disproof that this triangulation is a Delaunay triangulation. Your proof should be geometrically, meaning that you either illustrate the Delaunay property in the figure or illustrate that this property is violated.



All circles can be drawn with 3 points.

b) An interpolation function $f(x) = \sum_{i=1}^{N} w_i \, \varphi(\|p_i - x\|)$ is a weighted sum of N *radial functions* $\varphi(r) = e^{-r^2}$ where $\|p_i - x\|$ is the distance between the points p_i and x. Compute the weights w_i such that the function $f(p_i)$ interpolates the data points $p_1 = 1$, $p_2 = 3$, $p_3 = 3.5$ with corresponding scalar values $f_1 = 1$, $f_2 = 0$, $f_3 = \frac{1}{4}$.

The table below shows approximate values for $\varphi(r)$ with respect to different distances r.

r	0	0.5	1	1.5	2	2.5	3
$\varphi(r)$	1	4/5	2/5	1/10	0	0	0

c) Given the interpolation function $f(x)$ from the previous assignment, compute the interpolated value at point $x = 2$.