UNIVERSITÄT STUTTGART
Institut für Visualisierung und Interaktive Systeme (VIS)

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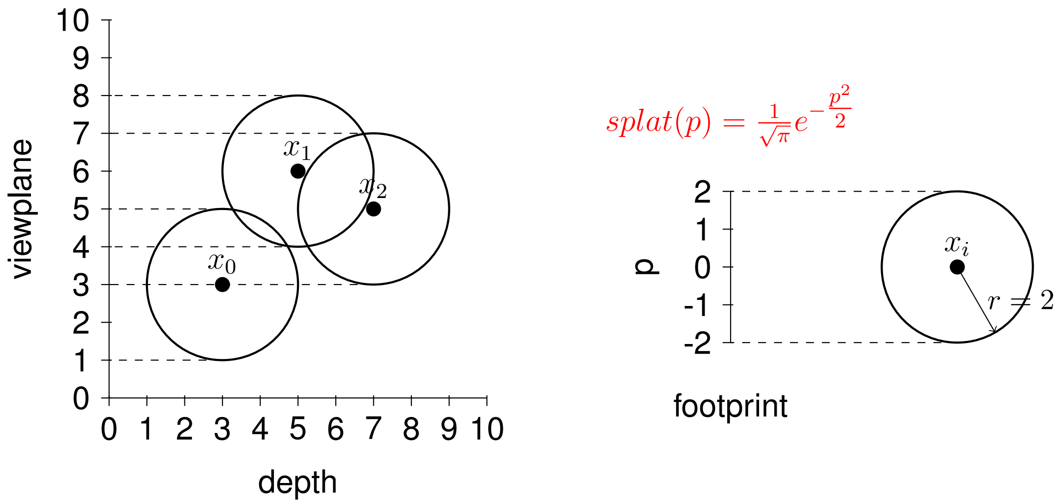
Scientific Visualization (Assignment 11)

Exercise 11. 1 [6 Points] Splatting

Volume splatting can be thought of as throwing balls filled with ink onto a canvas. Instead of accumulating color/density values of the volume data along a ray for each pixel, we project the data in terms of interpolation kernels directly on the viewplane and accumulate the color/opacity for each pixel. The interpolation kernel $w(x, y, z)$ is projected from a 3D to a 2D representation resulting in a "footprint": $splat(x, y) = \int w(x, y, z)\mathrm{d}z$. Each footprint is weighted by the scalar value of the respective sample point and its contribution to color/opacity is accumulated on the viewplane. For simplicity the radial kernels are illustrated as circles and the viewplane is the y-axis with orthographic projection in this exercise.



1. Evaluate the values for the 4 discrete pixels of the footprint by using the given projected Gaussian splat function $splat(p) = 1/\sqrt{\pi}\, e^{-p^2/2}$ at the center of each pixel as shown in the right figure (i.e., $p \in \{-1.5, -0.5, 0.5, 1.5\}$).

2. Weight the pixels of the footprint for all volume sample points in the left figure using their corresponding values: $f(x_0) = 3, f(x_1) = 6, f(x_2) = 1$. Evaluate the α and luminance values using the following transfer function:

   The solid line defines the transfer function for the luminance, the dashed line the transfer function for the opacity.

3. Accumulate the luminance values on the viewplane in back-to-front order using the calculated α-values and the back-to-front compositing formula from the lecture.

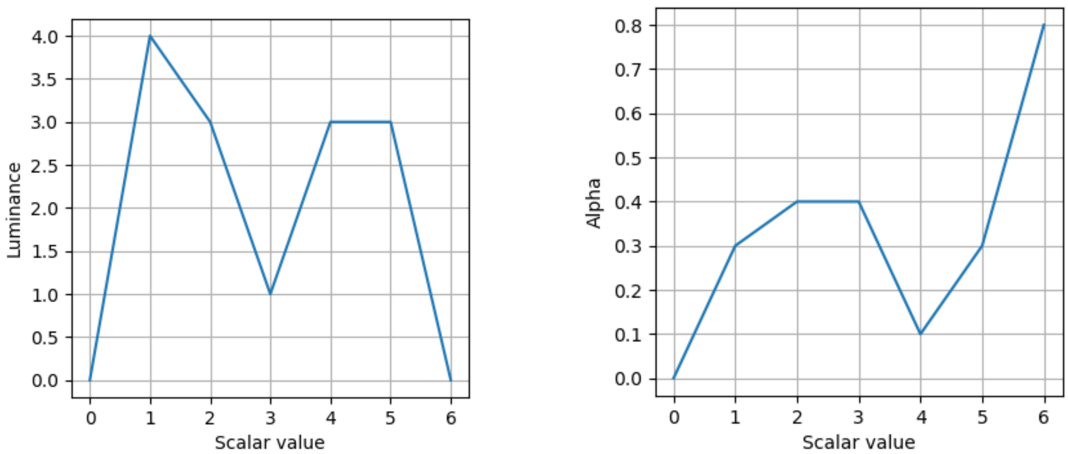


Figure 1: Transfer function.

Exercise 11. 2 [6 Points] Meshed Polyhedra Visibility Ordering (MPVO)

For certain rendering applications like cell projection a visibility ordering technique is needed to process the displayed primitives in the correct order. The Meshed Polyhedra Visibility Ordering (MPVO) method solves this problem for acyclic and convex grids. Figure 2 presents a mesh for which the MPVO method should be applied. We assume that the first phase of the algorithm, the neighborhood graph construction, has already been done.

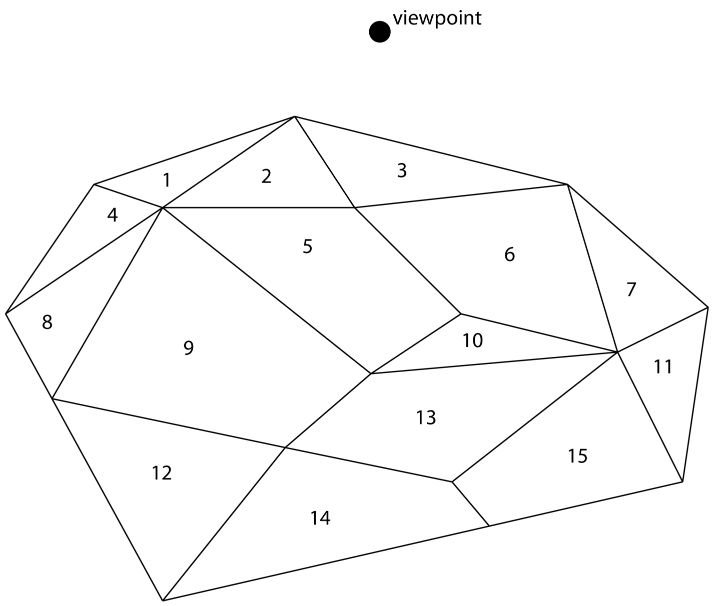


Figure 2

To continue with phase 2, please construct the directed acyclic graph that encodes the visibility relations. Please hand in a Figure of the graph alongside with a list of the source(s) and sink(s) of it. After that graph is constructed, perform a back-to-front depth sorting based on a breadth first search strategy and hand in the resulting order.

Submission Deadline: 05.07.2019, 23:55

please hand in your submission through the ILIAS system.

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