Problem Set 3

16825 Learning for 3D Vision (Spring 2024)
https://piazza.com/cmu/spring2024/16825

OUT: Feb. 21, 2024
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1. **[10 pts]**

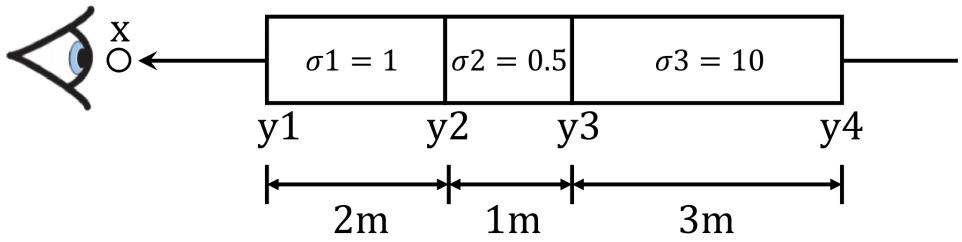

Figure 1: A ray through a non-homogeneous medium. The medium is composed of 3 segments ($y1y2$, $y2y3$, $y3y4$). Each segment has a different absorption coefficient, shown as $\sigma_1, \sigma_2, \sigma_3$ in the figure. The length of each segment is also annotated in the figure (1m means 1 meter).

As shown in Figure 1, we observe a ray going through a non-homogeneous medium. Please compute the following transmittance:

- $T(y1, y2)$
- $T(y2, y4)$
- $T(x, y4)$
- $T(x, y3)$

Solution

According to slide **L09_Volume_Rendering Page 42**:

$$T(x,y) = e^{-\sigma\|x-y\|}$$
$$T(x,y) = T(x,z)\cdot T(z,y)$$

Thus everything's solved.

$$T(y_1,y_2) = e^{-\sigma_1\|y_1-y_2\|} = e^{-1\times 2} = e^{-2}$$
$$T(y_2,y_4) = e^{-\sigma_2\|y_2-y_3\|}\cdot e^{-\sigma_3\|y_3-y_4\|} = e^{-0.5\times 1}\cdot e^{-10\times 3} = e^{-30.5}$$
$$T(x,y_4) = T(x,y_1)\cdot T(y_1,y_2)\cdot T(y_2,y_4) = 1\times e^{-2}\times e^{-30.5} = e^{-32.5}$$
$$T(x,y_3) = T(x,y_1)\cdot T(y_1,y_2)\cdot T(y_2,y_3) = 1\times e^{-2}\times e^{-0.5} = e^{-2.5}$$

Probably hitting an object between y_3 an y_4.