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]**

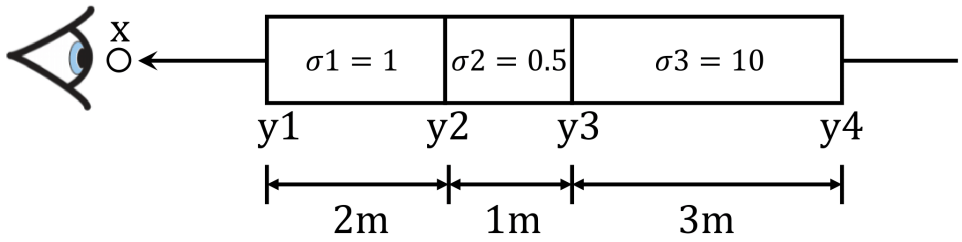

Figure 1: A ray through a non-homogeneous medium. The medium is composed of 3 segments ($y1y2$, $y2y3$, $y3y4$). Each segment has a different absorption coefficient, shown as $\sigma_1, \sigma_2, \sigma_3$ in the figure. The length of each segment is also annotated in the figure (1m means 1 meter).

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

Transmittance is calculated as

$$T(z) := e^{\int_0^z -\sigma(s)\,ds}$$

Now,

- $T(y1, y2)$:

$$e^{\int_{y1}^{y2} -\sigma(s)\,ds} = e^{-2}$$

- $T(y2, y4)$:

$$e^{\int_{y2}^{y4} -\sigma(s)\,ds} = e^{-0.5} + e^{-30}$$

- $T(x, y4)$:

$$e^{\int_{x}^{y4} -\sigma(s)\,ds} = e^{-2} + e^{-0.5} + e^{-30}$$

- $T(x, y3)$:

$$e^{\int_{x}^{y3} -\sigma(s)\,ds} = e^{-2} + e^{-0.5}$$