Problem Set 3

16825 Learning for 3D Vision (Fall 2023)
https://piazza.com/cmu/fall2023/16825

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1. **[10 pts]**

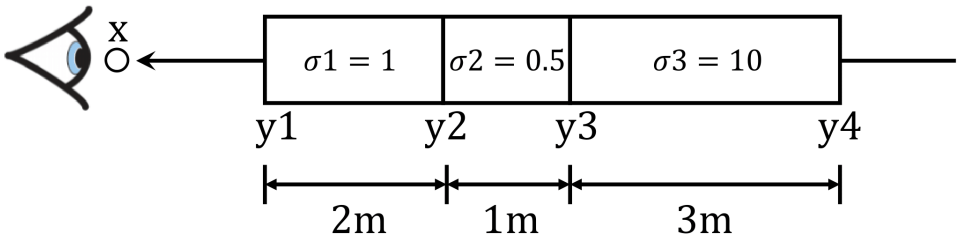

Figure 1: A ray through a non-homogeneous medium. The medium is composed of 3 segments ($y1y2$, $y2y3$, $y3y4$). Each segment has a different absorption coefficient, shown as $\sigma_1, \sigma_2, \sigma_3$ in the figure. The length of each segment is also annotated in the figure (1m means 1 meter).

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

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

- $T(y_1, y_2) = e^{-2}$

- $T(y_2, y_4) = [T(y_2, y_3)]\,[T(y_3 \times y_4)]$

$= [e^{-0.5}]\,[e^{-30}]$

$e^{-0.5-30}$

$T(y_2, y_4) = e^{-30.5}$

- $T(x, y_4) = T(x, y_3) \times e^{-(\sigma_{t_3} \Delta t_3)}$

$= T(x, y_2) \times e^{-(\sigma_{t_2} \Delta t_2)} \times e^{-(\sigma_{t_3} \Delta t_3)}$

$= T(x, y_1) \times e^{-(\sigma_{t_1} \Delta t_1)} \times e^{-(\sigma_{t_2} \Delta t_2)} \times e^{-(\sigma_{t_3} \Delta t_3)}$

$= 1 \times e^{-2} \times e^{-0.5} \times e^{-30}$

$T(x, y_4) = e^{-32.5}$

- $T(x, y_3) = 1 \times e^{-2} \times e^{-0.5} \Rightarrow T(x, y_3) = e^{-2.5}$