Angel and Shreiner: Interactive Computer Graphics, Eighth Edition

Chapter 8 Odd Solutions

8.1 If a surface has opacity α, a fraction $1 - \alpha$ of the light from behind it will pass through it and will be seen from the front. Now consider two surfaces with opacities α_1 and α_2. A fraction $1 - \alpha_1$ will pass through the first and this amount will be reduced by $1 - \alpha_2$ by passing through the second, leaving the same amount of light as would a surface with transparency $(1 - \alpha_1)(1 - \alpha_2)$ or equivalently the amount of light passing through a surface of opacity $1 - (1 - \alpha_1)(1 - \alpha_2)$.

8.3 There are two issues. First, if we use α and $1 - \alpha$ we avoid problems of having colors and opacities exceeding 1 and being clipped. However, by using this choice, the order in which we composite multiple surfaces matters which would not make a difference if we used α and 1.

8.5 Suppose that the histogram of the image is a function $f(x)$ where x is the luminance. The lookup table formed from the function $\int_0^x g(x')dx'$ will create an image with a flat histogram. A simple discrete example is illustrative. Suppose we have a image which is 1024 x 1024 and has 256 values of luminance. If the image we want to create is to have a flat histogram, there should be 4096 pixels with each luminance value. If we have the histogram of the original image, we can use this histogram to find which original luminance values we must use to obtain the lowest 4096 values to assign to 0, the next lowest 4096 to assign to 1, and so on. The function that describes this process is the integral of the histogram curve.