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Question 1

Given the image taken when the outside scene is in focus g_1, and the image when the reflection off the window is in focus g_2, along with the respective blurring kernels h_1 and h_2, we have

$$g_1 = f_1 + h_2 * f_2$$
$$g_2 = f_2 + h_1 * f_1$$

By applying Fourier transform on these equations, we get,

$$G_1 = F_1 + H_2 F_2$$

$$G_2 = F_2 + H_1 F_1$$

On further solving the system of linear equations for F_1, F_2,

$$F_1 = \frac{G_1 - H_2 G_2}{1 - H_1 H_2}$$

$$F_2 = \frac{G_2 - H_1 G_1}{1 - H_1 H_2}$$

Now, to obtain f_1 and f_2, we simply take the Fourier Inverse Transform of F_1 and F_2

$$\boxed{f_1 = \mathcal{F}^{-1}(F_1)}$$

$$\boxed{f_2 = \mathcal{F}^{-1}(F_2)}$$

Problem in the solution obtained

The inherent problem in the formula derived is that the Fourier transforms of the blurring kernels act as low pass filters. So, for low frequencies, $H_1 H_2$ will approach 1. If we look at the denominator of the formulae $1 - H_1 H_2$, we notice that for low frequencies, the denominator tends to ∞. This is will amplify the noise around low frequencies and hence is not ideal.