Yes, because after applying the low pass filter we are interpolating the image. Therefore, we are trying to restore the pixels of downsampled image

When you have a high res. image and you apply a low-pass filter your image will get blurred. I believe after downsampling a blurred image, it will look similar to the original one, but in just smaller size.

Quiz 1: Filters, Fourier Transforms, & Resizing

1. $f(g(x)) = \int_{-\infty}^{\infty} f(y)\, g(x-y)\, dy$

$$= \int_{-\infty}^{\infty} e^{\frac{-y^2}{2\sigma^2}} e^{-\frac{(x-y)^2}{2\sigma^2}}\, dy \qquad u = \frac{2y-x}{2\sigma}$$

$$dy = \sigma\, du$$

$$= \int \sigma e^{-u^2} e^{\frac{-x^2}{4\sigma^2}}\, du$$

$$= \int \frac{2e^{-u^2}}{\sqrt{\pi}}\, du = \operatorname{erf}(u)$$

$$= \frac{\sqrt{\pi}\,\sigma e^{-\frac{x^2}{4\sigma^2}}}{2} \int \frac{2e^{-u^2}}{\sqrt{\pi}}\, du = \frac{\sqrt{\pi}\,\sigma e^{\frac{-x^2}{4\sigma^2}} \operatorname{erf}(u)}{2}$$

$$= \frac{\sqrt{\pi}\,\sigma e^{\frac{-x^2}{2\sigma^2}} \operatorname{erf}\left(\frac{2y-x}{2\sigma}\right)}{2} + C$$

$$= \sqrt{\pi}\,\sigma\, e^{-x^2/4\sigma^2}$$

The relationship between σ_1 and σ_2 is that their computation equals σ_3

2 let $K = [x_0, x_1, x_2, x_3, x_4, x_5, x_6]$

$K = [c \quad b \quad a \quad b \quad c]$

$\therefore \; c + b + a + b + c = a + 2b + 2c = 1$

Odd : $a + b + 2c$ Even : $a + b + c$

odd = even

$a + b + 2c = \frac{1}{2}$ $a + b + c = \frac{1}{2}$

$2c = \frac{1}{2} - b - a$ $c = \frac{1}{2} - b - a$

$a = \frac{1}{2} - b - c$

$c = \dfrac{1/2 - b - a}{2}$

$b = \frac{1}{2} - a - c$

$a = 1/2 - b - 2c$

$$K = \begin{bmatrix} c \\ b \\ a \\ c \\ b \\ a \\ c \end{bmatrix} = \begin{bmatrix} 1/4 - b/2 - a/2 \\ 1/2 - a - c \\ 1/2 - b - 2c \\ 1/2 - b - a \\ \dfrac{\frac{1}{2} - b - a}{2} \end{bmatrix}$$