**Assignment 2**

2. An approach to lossless image compression is bit-plane extraction. Lossless compression methods preserve the exact original data and don't lead to data loss or image quality degradation. In order to extract individual bit planes from a picture, which represent the most important bits to the least important bits of the image data, bit-plane extraction must first divide the image into its component bit planes. Without losing any information, the image can be compressed by deleting the least important bit planes.

c)

No, as the information lost during bit plane slicing cannot be retrieved, neither 1st-order extrapolation nor 2D bilinear interpolation can restore the original image after bit plane slicing. Bit plane slicing is a lossy compression method that eliminates data from an image's high-order bits. The lost data cannot be recovered, and any extrapolation or interpolation attempts will produce an image that is not identical to the original. While interpolation can be used to estimate the number of missing pixels, it cannot recover the data that has been lost.

3. Some high frequency features would be lost if the low order bit planes were eliminated.

In addition, the image histogram will be less dense than in the case of an all-eight-bit plane.

High order bit plane removal would result in the removal of some crucial DC components from the image.

This means that the image will be significantly darker and that many low frequency components will be lost.

5. a)

Yes, a Gaussian filter still exists when an image is filtered four times using a 3x3 Gaussian kernel with a 1.0 standard deviation.

Since convolutions are associative, they can be concatenated into a single convolution, simulating the sequential application of each separate kernel. In this scenario, the multiple 3x3 Gaussian kernels can be convolved to form a single, bigger Gaussian kernel. The convolution of two Gaussian functions produces another Gaussian function, hence the final filter is still a Gaussian filter.

b)

sigma1=1, sigma2=1, sigma3=1, sigma4=1

Formula used: New sigma = sqrt(sigmaA^2 + sigmaB^2)

Using the above formula we can calculate the sigma which will come out to be **2**.

c)

Size of kernel is equal to (6\*sigma+1)( 6\*sigma+1)

13\*13

6) because the digital Laplacian can be defined by adding four more terms to Eq. because utilizing the kernel in Fig. 3.45(b) results in more differentiation (sharpening) in the diagonal directions (3-53). As a result of each diagonal term including a 2 f x(,)y term, the difference terms would now be reduced by a total of 8 f x. ( , ). The kernel used to implement this new definition is depicted in Figure 3.45(b). This kernel produces isotropic results in 45° steps.

10. a)

Yes, a Gaussian filter is produced. Since the three lowpass filters utilized in the composite filter are Gaussian, the composite filter that results will also be Gaussian since the convolution of Gaussian functions is likewise a Gaussian function.

b)

sigma1=1.5, sigma2=2, sigma3=4

Formula used: New sigma = sqrt(sigmaA^2 + sigmaB^2)

Using the above formula we can calculate the sigma which will come out to be **4.7**.

c)

Size of kernel is equal to (6\*sigma+1)( 6\*sigma+1)

Which is roughly 29\*29.