Problem #1: Image quantization and quality measurement (60%)

In quantization, we map an input value $\mu$ to $Q(u)$ by the following rule

$$Q(u) = r_i, \text{if } t_i \leq u < t_{i+1}$$

where $t_i$ are the decision boundaries and $r_i$ are the reconstruction values. For a uniform quantizer, $r_i = (t_i + t_{i+1})/2$, $t_i = i \cdot \Delta$, $i = 0 ... (n-1)$, and $\Delta$ is the quantization step size.

Write a function to implement a 3D uniform quantizer in the RGB color space and measure the quality of the output image, in terms of SNR (dB).

```matlab
function [imgq,snr] = colorquanz(img, n1, n2, n3)
```

where `img` is the input image, `n1`, `n2`, and `n3` specify the numbers of quantization steps in each color dimension (R,G,B) respectively, `imgq` stores the quantized output image, and `snr` is the SNR value of the quantized image.

Use ‘lena.bmp’ as the input image, plot the quantized image and compute the snr value for each of the following two conditions (1) \(n1=n2=n3=4\) and (2) \(n1=n2=n3=6\).

P.2 HDTV resolution (40%)

Problem 2.10 in the G&W textbook