EE 4830 Digital Image Processing **Homework #2**

Due Date: Feb. 24th 2005

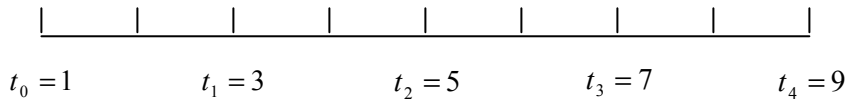
Problem #1: Image quantization and Huffman Coding (50%)

Readings: Lecture notes plus Chapter 4.5-4.10 of Jain

Consider a random variable u, which have 8 different levels. Its probability distribution function is:

$$p(u) = \begin{cases} 1/16, & u = 1,2 \\ 1/8, & u = 3 \\ 1/4, & u = 4,5 \\ 1/8, & u = 6 \\ 1/16, & u = 7,8 \end{cases}$$

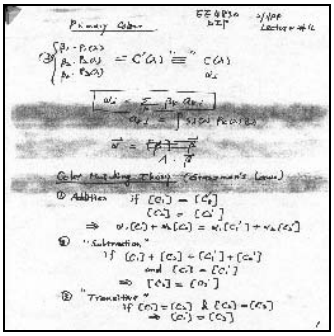
We want to design a quantizer to quantize u to 4 levels. Suppose the decision levels $t_0 \sim t_4$ have been chosen to be:



Calculate the optimal reconstruction values $r_k, k = 0,1,2,3$, so that the MSE is minimized. Note $Q(u) = r_i, if\ t_i \le u < t_{i+1}$

Problem #2: (50%)

Readings: G&W Chap 3, Jain Chap 7



In this problem, you are asked to design and implement image enhancement techniques to improve the quality of a quality impaired image of your choice. Choose one of the two images available at the class web site, coin.tif and document.tif.

(1) Use any method or combinations from the following list.

- contrast stretching
- filter sharpening (Laplacian, Sobel, etc)
- histogram matching (to any target histogram you desire)
- power-law or log transform

Select the best method or combinations that you think will achieve the largest quality improvement. Feel free to choose your quality criteria (e.g., contract, sharpness, details), but you have to clearly specify the one(s) you adopt.

For this problem, you need to submit

(a) descriptions and justification of your approaches, including information about how you determine the required parameters (if any)

(b) plots of the output images

(c) analysis of the image quality (before and after improvement)

(d) the program codes of your implementations