

# EE.5351 Digital Video Coding

Instructor: K.R.Rao

Test #2  
(Closed Book & Closed Notes)

July 11 (Tuesday), 2006  
6:00 – 7:50 P.M.

Student Name: \_\_\_\_\_  
Student ID: \_\_\_\_\_

1. [5 points]

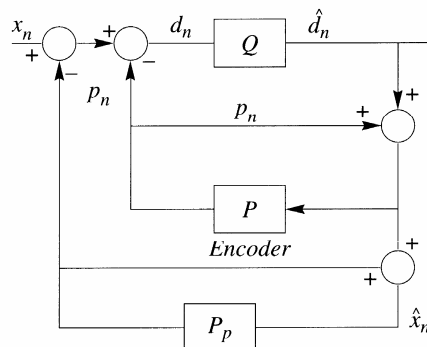


Fig. The DPCM Encoder

Given double predictor DPCM encoder, sketch the corresponding decoder.

2. [5 points]

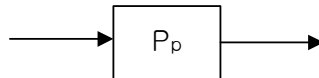
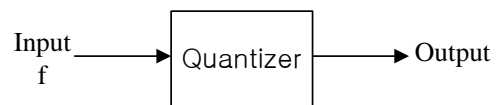


Fig. Pitch predictor

What is the role of this in speech coding?

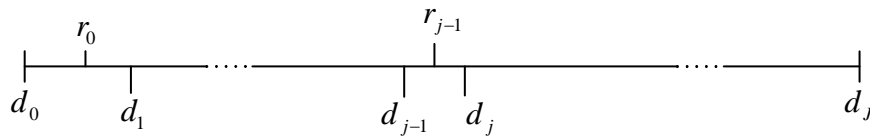
3. [15 points]



In scalar quantization, one design involves minimizing the following equation,

$$MSQE = \sum_{l=0}^{J-1} \int_{d_l}^{d_{l+1}} (f - r_l)^2 p(f) df$$

where  $p(f)$  is p.d.f. of  $f$ ,  $r_i$  and  $d_i$  are the variables.



$d_i$  :  $i=0,1, \dots, J$  decision (input) levels

$r_i$  :  $i=0,1,\dots,J-1$  representative (output) levels

Obtain the expressions for  $r_i$  and  $d_i$ .

4. [10 points]

We can force a uniform quantizer on a signal with nonuniform pdf (assume the pdf is symmetric and extends from  $-\infty$  to  $\infty$ , such as Gaussian & Laplacian). For a given # of output levels  $L$ , the only variable is step size  $\Delta$ . What are the factors affected by the choice of  $\Delta$ ? Describe in detail.

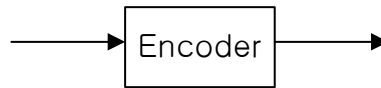
5. [20 points]

$\mu$ -law Companding is defined as

$$c(x) = x_{\max} \frac{\ln\left(1 + \mu \frac{|x|}{x_{\max}}\right)}{\ln(1 + \mu)} \operatorname{sgn}(x)$$

For this compander, obtain the corresponding expander (consider only  $x > 0$ )

6. [10 points]



In VQ, what are all the factors involved in the encoder?

7. [5 points]

What is BSVQ? What are its advantages & disadvantages?

8. [10 points]

What is gain shape VQ? Sketch encoder/decoder block diagrams.

9. [10 points]

What is multistage VQ? Sketch a 3-stage VQ (encoder only).

10. [10 points]

What is classified VQ? Sketch both encoder/decoder block diagrams.  
What are its advantages & disadvantages?