EE 610 Homework 2
Due October 18, 2000

1. Consider the $R = 1/2$, $K = 4$ code with

$$\mathbf{G}(D) = [1 + D^2 + D^3, 1 + D + D^2 + D^3].$$

   (a) Draw the code tree for an information sequence of length $L = 4$.

   (b) Find the code word corresponding to the information sequence $\mathbf{u} = (1001)$.

2. For the binary input, 8-ary output DMC with transition probabilities $P(r_i|v_i)$ given by the following table:

$P(r_i\|v_i)$	$r_i = 0_1$	0_2	0_3	0_4	1_1	1_2	1_3	1_4
$v_i = 0$	0.434	0.197	0.167	0.111	0.058	0.023	0.008	0.002
1	0.002	0.008	0.023	0.058	0.111	0.167	0.197	0.434

   and for the code of Problem 1, find an integer metric table for the Fano metric. (*Hint:* Scale each metric by an appropriate factor and round to the nearest integer.)

3. Consider the code of Problem 1 and a BSC with $p = 0.045$.

   (a) Find an integer metric table for the Fano metric.

   (b) Decode the received sequence

$$\mathbf{r} = [11, 00, 11, 00, 01, 10, 11]$$

   using the stack algorithm.

   (c) Decode the received sequence

$$\mathbf{r} = [11, 10, 00, 01, 10, 01, 00]$$

   using the stack algorithm. Compare the final decoded path with the decoded path if the Viterbi algorithm is used.

4. Repeat the example worked in class: $R = 1/3$ code with

$$\mathbf{G}(D) = [1 + D, 1 + D^2, 1 + D + D^2],$$

   a metric table given as

$M(r_i\|v_i)$	$r_i = 0$	1
$v_i = 0$	1	-5
1	-5	1

   and a received sequence of

$$\mathbf{r} = [010, 010, 001, 110, 100, 101, 011]$$

   (a) Using the stack-bucket algorithm with a bucket quantization interval of 5. Assume that the bucket intervals are $\ldots, +4$ to $0, -1$ to $-5, -6$ to $-6, \ldots$.

   (b) Using the stack-bucket algorithm with a bucket quantization interval of 9. Assume that the bucket intervals are $\ldots, +8$ to $0, -1$ to $-9, -10$ to $-18, \ldots$.

5. Repeat Problem 3 for the Fano algorithm with threshold increments of $\Delta = 5$ and $\Delta = 9$. Compare the final decoded path and the number of computations to the resutls of the examples worked in class and to the results of Problem 3.