REVA UNIVERSITY

DEPARTMENT OF ELECTRONICS & COMMUNICATION

Information theory and coding (Code: 14ECS21)

Date: 26/08/2015 Deadline: Monday (26/10/15) Morning *Homework 4 for B.E ECE (V Sem)*

1. Consider a (6,3)- Linear Block Code with Parity matrix given by

$$P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

   (i) What is the corresponding generator matrix (G) and parity check matrix (H) for this LBC.

   (ii) Make a table and list all the codewords for all the messages.

   (iii) For some coredowds veryfy that $\mathbf{cH}^T = 0$.

   (iv) Assuming that the codeword has 1-bit error correcting capability, write all the possible 1-bit error patterns. Compute syndrome for each error pattern and make a table of that.

   (v) Now if at the receiver, we receive $\mathbf{r} = [111101]$. Is there any error? If yes detect the error and using syndromes computed in part (iv) correct the error and write the codeword and hence the actual message which was transmitted.

   (vi) Draw the encoding circuit and syndrome computing circuit for this code.

   (v) Is this a Hamming code? If yes how? If not why?

2. Again consider a simple (6,3)-Linear block code, now we are given the generator matrix for this code as

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$$

   (i) For this code find the parity matrix and parity chech matrix.

   (ii) If $\mathbf{m}$ denote the message vector (as defined in class) and $\mathbf{b}$ denote the parity bit vector, then based on parity matrix write the relation between components of $\mathbf{b}$ with $\mathbf{m}$.

   (iii) Write all the codewords corresponding to all the messages for this code.

   (iv) Find the Hamming weight of all the codewords, and also minimum hamming weight of the code.

   (v) For this code also, draw encoding circuit and syndrome computation circuit.

3. Consider a (7,4) Hamming code with parity matrix given as

$$P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

Student's name:

Please go on to the next page...

(i) Write all the codewords for this code.

(ii) What is the minimum Hamming weight for this code.

(iii) Since this is Hamming code, then based on the relation between d_{min} and no. of bits that this code can correct (t), find t for this code.

(iv) Draw the encoding circuit for this code.

4. **Roll No. Based problem** Based on the roll number , this problem will be different for different students. This is reading problem, i.e., you will have to read some section from Simon Haykin book and then solve the problem.

Roll No.	Problem assigned
1-10	Problem 10.6
11-20	Problem 10.7
21-30	Problem 10.9
31-40	Problem 10.8
41-50	Problem 10.4
51-60	Problem 10.5
175-182	Construct Hamming code with $m = 4$ (i.e. $k = 11, n = 15$).