

ECS 452: In-Class Exercise # 12

Instructions

1. Separate into groups of no more than three persons.
2. The group cannot be the same as your former group.
3. Only one submission is needed for each group.
4. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
5. **Do not panic.**

Date: 20/04/2017			
Name			ID (last 3 digits)
Prapun			5 5 5

Consider a block code whose generator matrix is

$$G = \left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{array} \right]$$

I_3
 P

a. Find the parity check matrix H of this code.

$$H = \left[\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{array} \right]$$

P^T
 I

b. Suppose we receive $\underline{y} = 101000$.

i. Find the syndrome vector \underline{s}

$$\underline{s} = \underline{y} H^T = \left[\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} \right]^T = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}^T = [0 \ 1 \ 1]$$

ii. Find the decoded codeword $\underline{\hat{x}}$

The syndrome \underline{s} is the same as the second column of H .

Therefore, $\underline{\hat{e}} = [0 \ 1 \ 0 \ 0 \ 0 \ 0]$ and

$$\underline{\hat{x}} = \underline{\hat{y}} - \underline{\hat{e}} = \underline{\hat{y}} \oplus \underline{\hat{e}} = [1 \ 1 \ 1 \ 0 \ 0 \ 0]$$

iii. Find the decoded message $\underline{\hat{b}}$.

$$\underline{\hat{b}} = [1 \ 1 \ 1]$$

From G , we have I_3 in the front, so the message \underline{b} will be the first three bits of the codeword \underline{x} .