SOMAIYA VIDYAVIHAR UNIVERSITY

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Course :
Experiment / assignment / tutorial No.
Grade: Signature of the Faculty with date

Q1) For a (6,3) Linear Block code, the parity bits are derived from following equations.

$P_4 = d_1 \oplus d_2$

$P_5 = d_1 \oplus d_2 \oplus d_3$

$P_6 = d_2 \oplus d_3$

a) Find generator matrix

b) Find all code words

Q2) For a linear block code H matrix is given by

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

a) What is value of n and k of this linear block code

b) If the recevied code word is [0001101], find syndrom and comment about it

Q3) Define hamming distance and hamming weight with example

Q2) $H = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$

V_I

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

a) $n = 7 \quad k = 4$

$n - k = 3$

b) $H^T = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

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

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

$[C_1, C_2, C_3, C_4, C_5, C_6, C_7] = [D_1, D_2, D_3, D_4] \cdot G$

$(D_1 \oplus D_3 \oplus D_4)\ (D_1 \oplus D_2 \oplus D_3)$

$D_1, D_2, D_3, D_4, (D_1 \oplus D_3 \oplus D_4), (D_1 \oplus D_2 \oplus D_3), (D_2 \oplus D_3 \oplus D_4$

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Codeword :- 0001101

$$S = (0001101)\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= [0, 0, 0]$$

There is no error received codeword is correct

Q3) If there are binary datas the if ~~take~~ the count the number of bits that are flipped in the ~~data~~ com data that is received compared to data that is sent. This is called hamming distance

ex. 0001101
1011101
In this the hamming distance is 2.

The count of the number of non zero components in a given codeword is called as the hamming weight.

ex. 0111011
In this the hamming weight would be 6.

Q1) a) $G = [I_3 \mid P]$

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

b) $\text{Code word} = [C]_{1\times 6} = [P]_{1\times 3} \times [G]_{3\times 6}$

$$[C_1\ C_2\ C_3\ C_4\ C_5\ C_6] = [d_1\ d_2\ d_3] \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

$$= [d_1, d_2, d_3, (d_1 \oplus d_2), (d_1 \oplus d_2 \oplus d_3), (d_2 \oplus d_3)]$$

d_1	d_2	d_3	c_1	c_2	c_3	c_4	c_5	c_6
0	0	0	0	0	0	0	0	0
0	0	1	0	0	1	0	1	1
0	1	0	0	1	0	1	1	1
0	1	1	0	1	1	1	0	0
1	0	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0	1
1	1	0	1	1	0	0	0	1
1	1	1	1	1	1	0	1	0