Computer Networks

Homework 4

Vili Perse – 89201253

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Problem 1:

Given a message $\mathbf{d}$=10011011 and a generator polynomial $g(x)$=x^5 +x^3 +1, find the codeword to be transmitted.

$\mathbf{d} = 10011011$

$g(x) = x^5 + x^3 + 1$

$g = 101001$

$\delta g = 5$

$\mathrm{d}^* = 10011011\ 00000$

$\mathrm{r} = \mathrm{d}^*\ \%\ g$

$1001101100000\ \%\ 101001$

$101001 \quad \oplus$

0011111100000

$\quad 101001 \quad \oplus$

$\quad 01011000000$

$\quad\ 101001 \quad \oplus$

$\quad\ 0001010000$

$\qquad\ 101001 \quad \oplus$

$\qquad\ 0000010$

$\mathrm{r} = 10$

$\mathrm{C} = \mathrm{d}^* + \mathrm{r} = 1001101100000 + 10 = 1001101100010$

Problem 2:

Encode the message 11001100 using the Hamming code. Assume the codeword bit at position 4 was changed during transmission, and check if the receiver detects/corrects the error.

Pos.:	1	2	3	4	5	6	7	8	9	10	11	12
Labels:	p0	p1	d1	p2	d2	d3	d4	p3	d5	d6	d7	d8
Bits:	?	?	1	?	1	0	0	?	1	1	0	0

$p = 3 \oplus 5 \oplus 9 \oplus 10 = 0011 \oplus 0101 \oplus 1001 \oplus 1010 = 0101$

p0 = 1, p1 =0, p2 = 1 and p3 = 0

CW = 101110001100

CW* = 101010001100

Pos.:	1	2	3	4	5	6	7	8	9	10	11	12
Labels:	p0	p1	d1	p2	d2	d3	d4	p3	d5	d6	d7	d8
Bits:	1	0	1	0	1	0	0	0	1	1	0	0

$p = 3 \oplus 5 \oplus 9 \oplus 10 = 0011 \oplus 0101 \oplus 1001 \oplus 1010 = 0101$

$p^* = 0001$

$p \oplus p^* = 0101 \oplus 0001 = 0100 \neq 0$

Detected error at position 0100 = 4!