Computer Networks

Homework 4

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# Problem 1:

Given a message 𝐝=10011011 and a generator polynomial 𝑔(𝑥)=𝑥5 +𝑥3 +1, find the codeword   
to be transmitted.

𝐝 = 10011011

𝑔(𝑥) = 𝑥5 + 𝑥3 + 1

𝑔 = 101001

δ𝑔 = 5

d\* = 10011011 00000

r = d\* % 𝑔

1001101100000 % 101001

101001 ⊕

0011111100000

101001 ⊕

01011000000

101001 ⊕

0001010000

101001 ⊕

0000010

r = 10

C = d\* + 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 ⊕ 5 ⊕ 9 ⊕ 10 = 0011 ⊕ 0101 ⊕ 1001 ⊕ 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 ⊕ 5 ⊕ 9 ⊕ 10 = 0011 ⊕ 0101 ⊕ 1001 ⊕ 1010 = 0101

p\* = 0001

p ⊕ p\* = 0101 ⊕ 0001 = 0100 ≠ 0

Detected error at position 0100 = 4!