

Problem #1

A 7-bit word with binary value 1001001 is to be encoded using an even-parity Hamming code. What is the binary value after encoding?

a b 1 c 0 0 1 d 0 0 1

$$\text{bit } 3 = 1+2$$

$$5 = 1+4$$

$$6 = 2+4$$

$$7 = 1+2+4$$

$$9 = 1+8$$

$$10 = 2+8$$

$$11 = 1+2+8$$

1: 3,5,7,9,11 \Rightarrow even parity gives a = 1

2: 3,6,7,10,11 \Rightarrow even parity gives b = 1

4: 5,6,7 \Rightarrow even parity gives c = 1

8: 9,10,11 \Rightarrow even parity gives d = 1

Final binary value after encoding:

1 1 1 1 0 0 1 1 0 0 1

Problem #2

A bit stream 1101001 is transmitted using the standard CRC method described in the text. The generator polynomial is x^3+1 . Show the actual bit string transmitted. Suppose that the second and sixth bits from the left are inverted during transmission. Determine whether the error is detected.

$r = 3$ (degree of generator polynomial)

$$M(x) \Rightarrow 1\ 1\ 0\ 1\ 0\ 0\ 1$$

$$G(x) = x^3+1 \Rightarrow 1\ 0\ 0\ 1$$

$$x^r M(x) \Rightarrow 1\ 1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0$$

$$\begin{array}{r} 1\ 0\ 0\ 1 \quad \overline{) \begin{array}{r} 1\ 1\ 0\ 0\ 1\ 0\ 1 \\ 1\ 1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0 \\ \underline{1\ 0\ 0\ 1} \\ 1\ 0\ 0\ 0 \\ \underline{1\ 0\ 0\ 1} \\ 1\ 0\ 1\ 0 \\ \underline{1\ 0\ 0\ 1} \\ 1\ 1\ 0\ 0 \\ \underline{1\ 0\ 0\ 1} \\ 1\ 0\ 1 \end{array}} \\ 1\ 0\ 1 \Rightarrow \text{remainder } x^2+1 \end{array}$$

Bit string with errors: 1 0 0 1 0 1 1 1 0 1

Problem 3.3

A B ESC C ESC FLAG FLAG D. What is the output after stuffing?

Problem 3.10

Problem 3.11

Problem 3.17

Efficiency will be 50% when the time to transmit the frame equals the roundtrip propagation delay. At a transmission rate of 4 bits/ms, 160 bits takes 40 ms. For frame sizes above 160 bits, stop-and-wait is reasonably efficient.