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

$1\cdot1 \oplus 0\cdot0 \oplus 1\cdot0 \oplus 1\cdot0 = 1$

$1\cdot0 \oplus 0\cdot1 \oplus 1\cdot0 \oplus 1\cdot0 = 0$

a) $i = [1\ 0\ 1\ 1]$ $\quad i \cdot G = c$

$[1\ 0\ 1\ 1] \cdot [I \mid \cdots] = [1\ 0\ 1\ 1\ 0\ 0\ 0] = c$

b) $H = [\ \cdots \mid I_{3\times3}]$

c) $r = 1010111$

$1\cdot1 + 1\cdot0 + 1\cdot1 + 0\cdot0 + 1\cdot1 + 0\cdot1 + 0\cdot1 = 1$

$z = r \cdot H^T$

$z \neq 0$ erori

| e | $z^T$ |
|---|---|
| 1000000 | 110 |
| 0100000 | 111 |
| ⋮ | ⋮ |
| 0000100 | 101 |

$\Rightarrow$ eroare pe poz 5

$c = 1010011$

$i = 1010$

d) $e_d = 2$

$e_c = 1$

$0 = c_4 \oplus i_5 \oplus i_6 \oplus i_7$

$0 = 0 \cdot c_4 + 1 \cdot (c_2 \oplus i_3 \oplus i_6 \oplus i_7)$

(2)

$$\begin{bmatrix}0\\0\\0\end{bmatrix} = \underbrace{\begin{bmatrix}0&0&0&1&1&1&1\\0&1&1&0&0&1&1\\1&0&1&0&1&0&1\end{bmatrix}}_{H} \cdot \begin{bmatrix}c_1\\c_2\\i_3\\c_4\\i_5\\i_6\\i_7\end{bmatrix}$$

$(i_1)$

$0 = c_1 \oplus i_3 \oplus i_5 \oplus i_7$

$i_A = [1001] \rightarrow c_A = [0011001]$

$i_B = [1110] \rightarrow c_B = [0010110] \Rightarrow [1\,0010110]$

Hamming SECDED (8,4)

Hamming (7,4)

$P$ — parity

(3)

$$z = \begin{bmatrix}1\\1\\0\end{bmatrix} = \begin{bmatrix}0&0&0&1&1&1&1\\0&1&1&0&0&1&1\\1&0&1&0&1&0&1\end{bmatrix} \cdot \begin{bmatrix}1\\0\\1\\0\\1\\1\\1\end{bmatrix}$$

$z \neq 0 \Rightarrow$ Erori

$(110)_2 = 6 \Rightarrow$ eroare pe poz. 6 $(i_6)$

corect = $1\,0\,1\,0\,1\,0\,1$

$c_1\,c_2\,i_3\,c_4\,i_5\,i_6\,i_7$

(4)

$$z = \begin{bmatrix}0\\0\\0\\0\end{bmatrix} = \begin{bmatrix}1&1&1&1&1&1&1\\0&0&0&1&1&1&1\\0&1&1&0&0&1&1\\0&1&0&1&0&1&0\end{bmatrix} \cdot \begin{bmatrix}1\\0\\1\\0\\1\\0\\1\end{bmatrix} \leftarrow c_0$$

$\tilde{H}$

$z^T$

$z = 0 \Rightarrow$ no errors

Alternative:

$z = \begin{bmatrix}1\\0\\0\\0\end{bmatrix} \begin{matrix}z_0\\ \Rightarrow \\ \text{poz}\end{matrix}$

1) Sunt erori ✓

2) $z_0 = 1 \Rightarrow$ 1 eroare

3) $\begin{matrix}0\\0\\0\end{matrix}$ = poziția erorii

poz = 0 $(c_0)$

$z = \begin{bmatrix}1\\0\\1\\1\end{bmatrix} \begin{matrix}z_0\\ \Rightarrow \\ =3\end{matrix}$

1) Sunt erori

2) $z_0 = 1 \Rightarrow$ 1 eroare

3) Poz erorii = 3 $(i_3)$

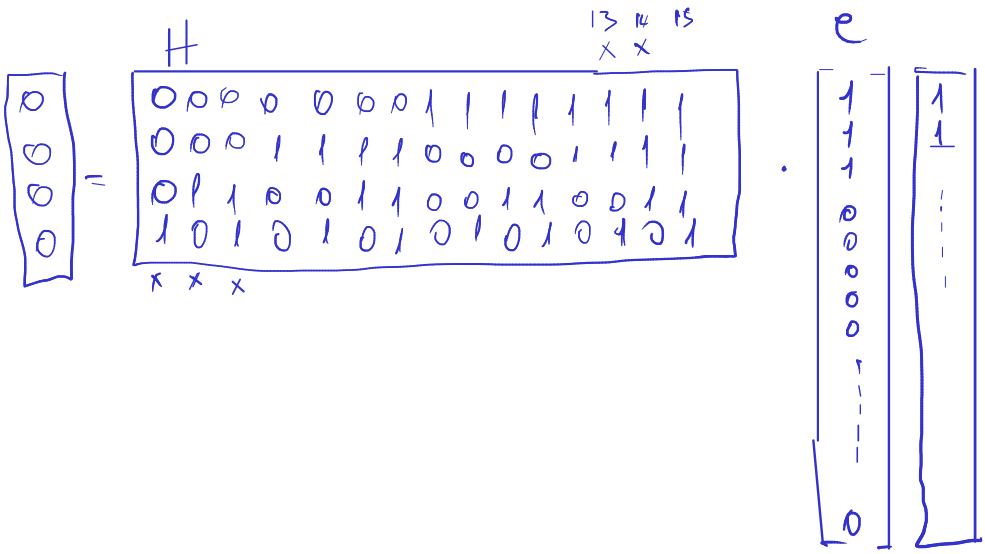
$z = \begin{bmatrix}0\\1\\0\\0\end{bmatrix} \begin{matrix}z_0\\ \Rightarrow \end{matrix}$

1) Sunt erori

2) $z_0 = 0 \Rightarrow$ 2 erori

Nu putem să le corectăm

5 Hamming (15, 11)




a) b)

e



a) grupul de erori pe poz 1, 2, 3 nu pot fi det

b) erori pe poz 1 si 2 (1 si 2)

$\Rightarrow z = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \end{bmatrix}$

erori pe poz (13 si 14)

$z = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \end{bmatrix}$

$z \neq 0 \Rightarrow$ detectate

altfel $z \Rightarrow$ nu pot fi det