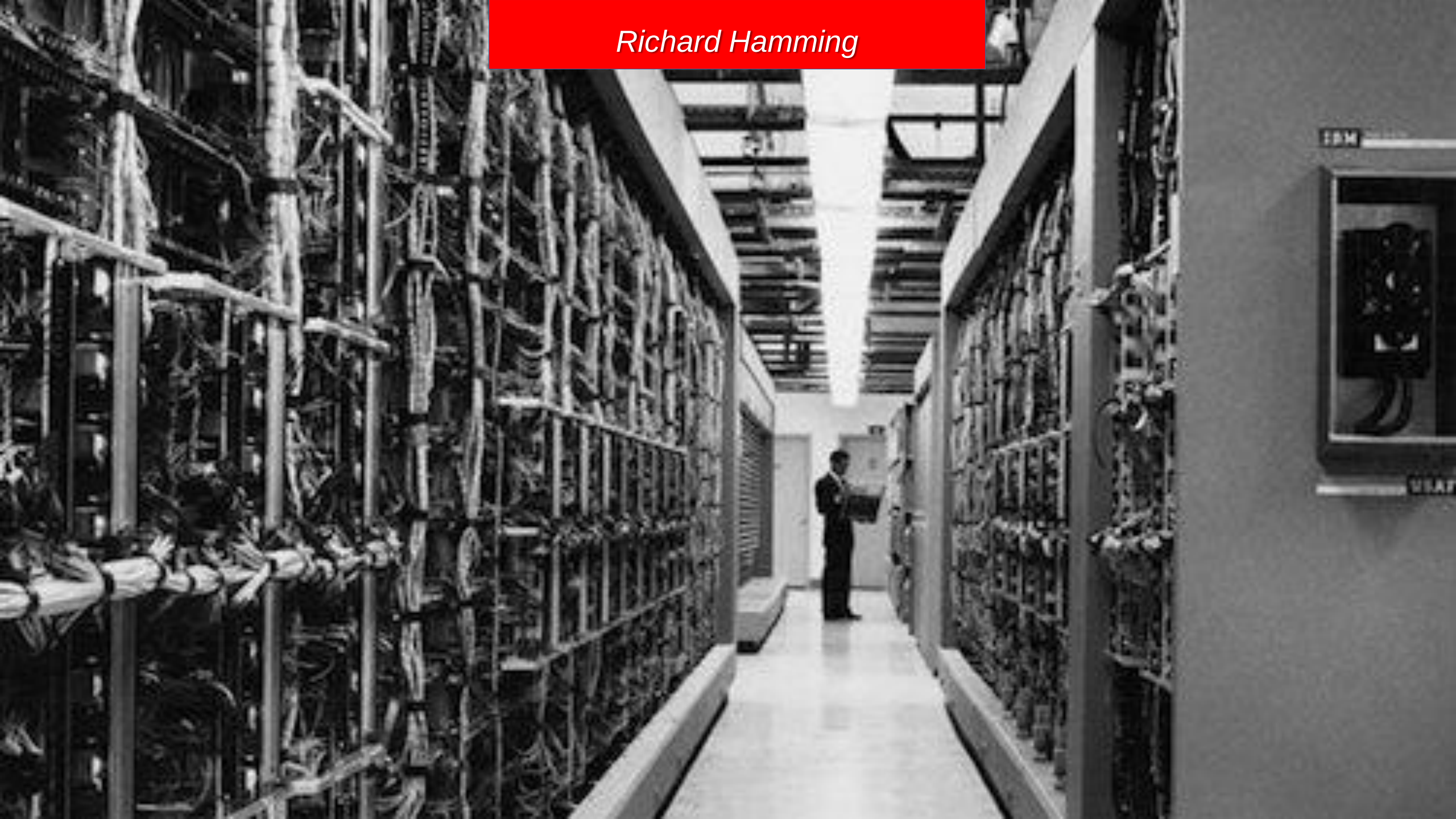
RICHARD HAMMING

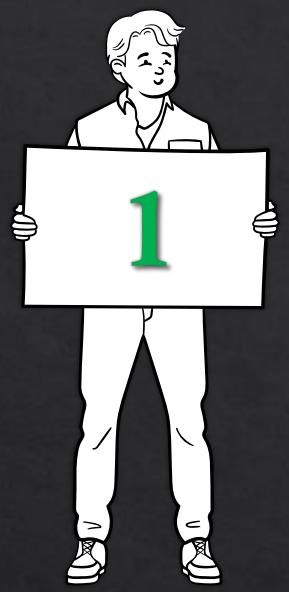
l'uomo che ha sconfitto gli errori

Leonardo Errati, UniTN
MSc Cryptography

Richard Hamming



Correggere un errore



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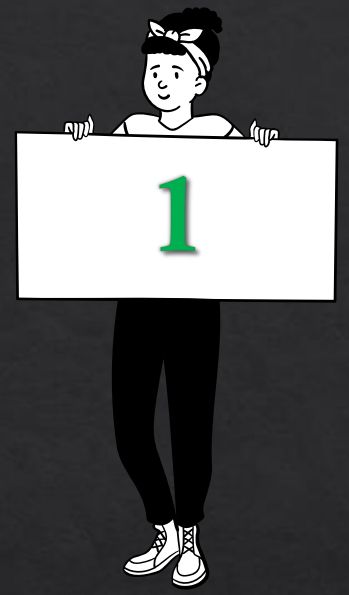

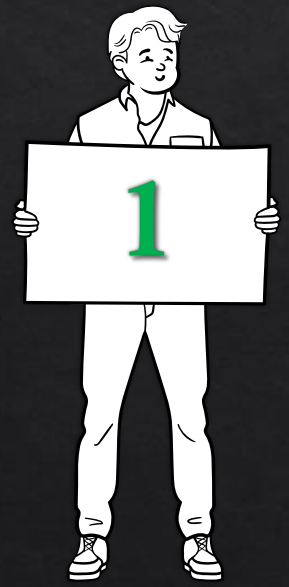

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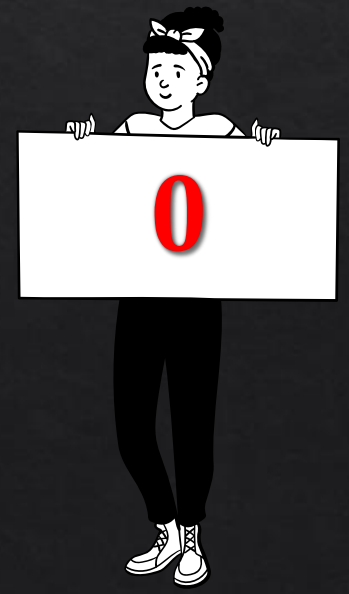
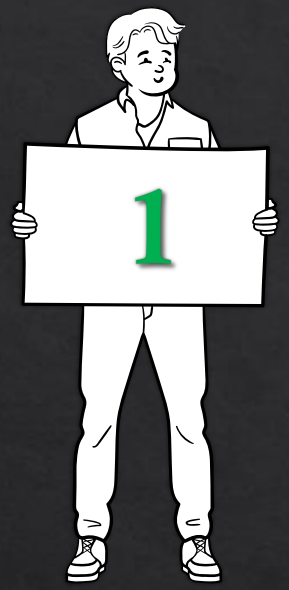
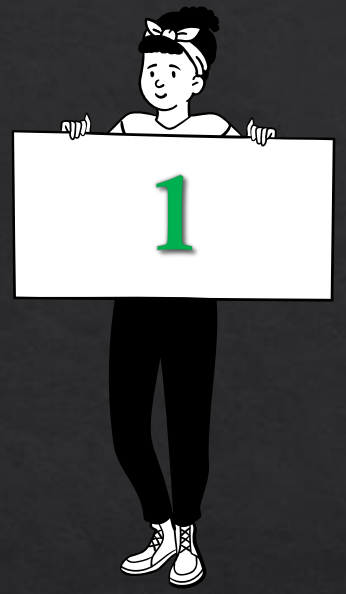
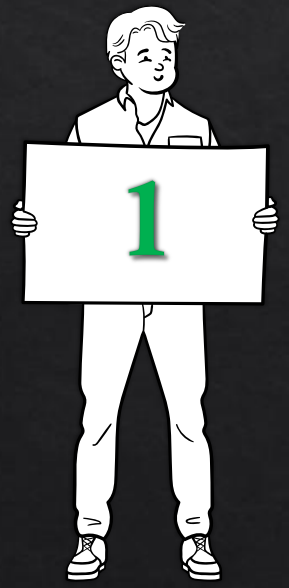


Codici a ripetizione

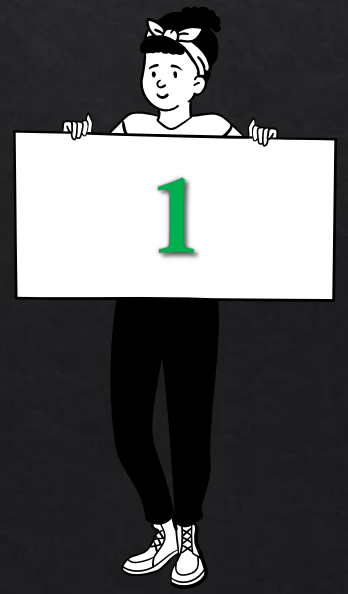


111





111 101



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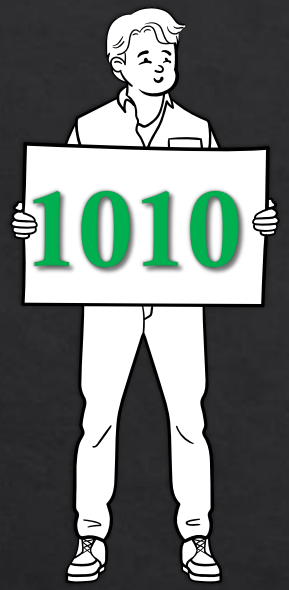
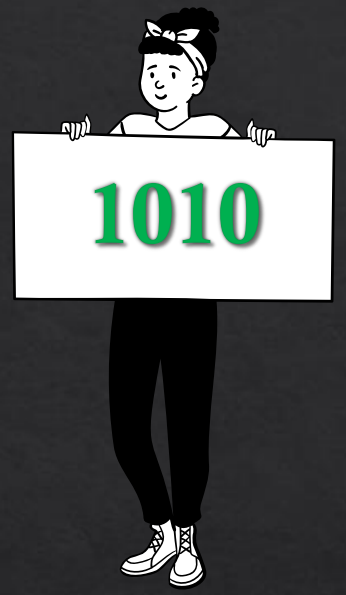
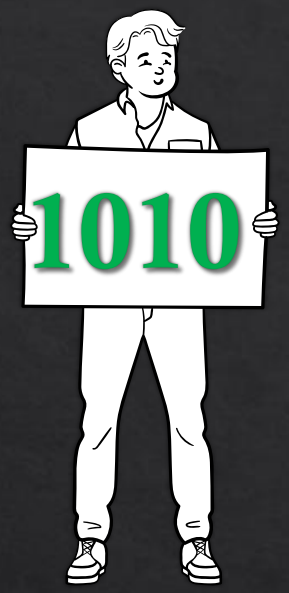


111000111000



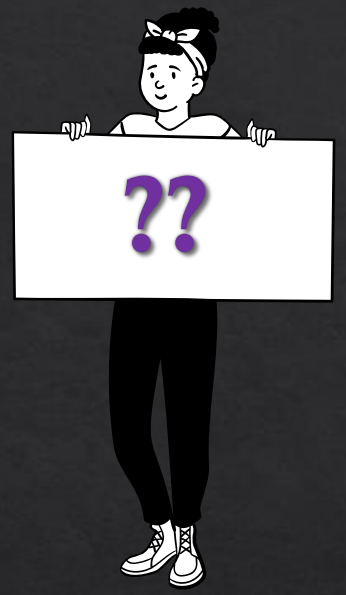
codice a ripetizione: inefficiente

Parity check



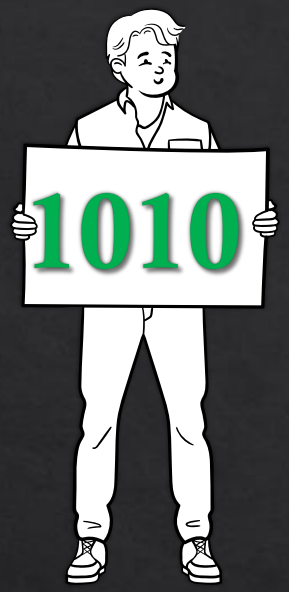
10(1)

11(1)



parity check bit:
non corregge

Codici di Hamming



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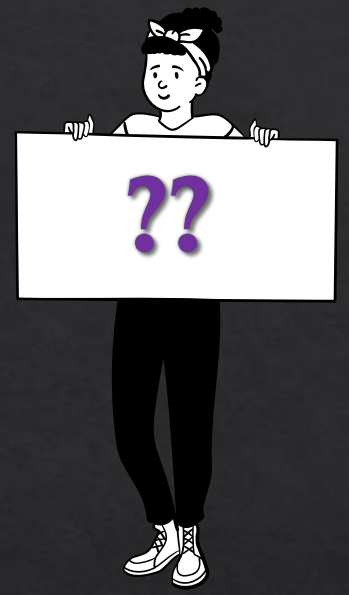
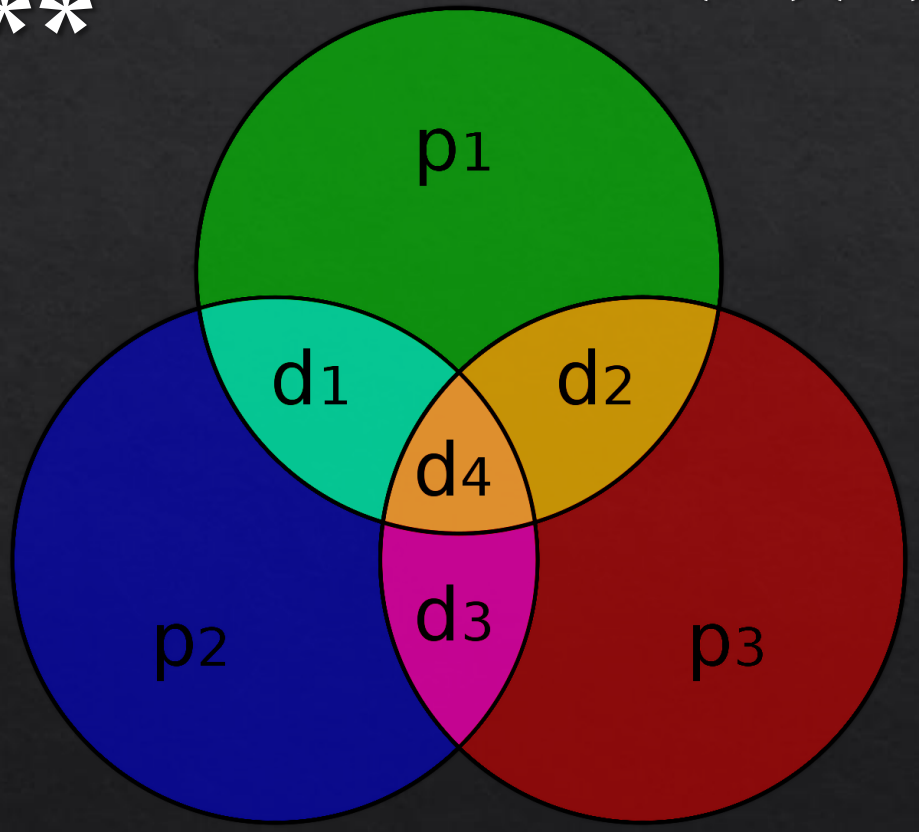


cosa possiamo inviare?

Codici di Hamming

$$(d_1)(d_2)(d_3)(d_4)(p_1)(p_2)(p_3)$$
$$(\,1\,)(\,0\,)(\,1\,)(\,0\,)(\,?\,)(\,?\,)(\,?\,)$$

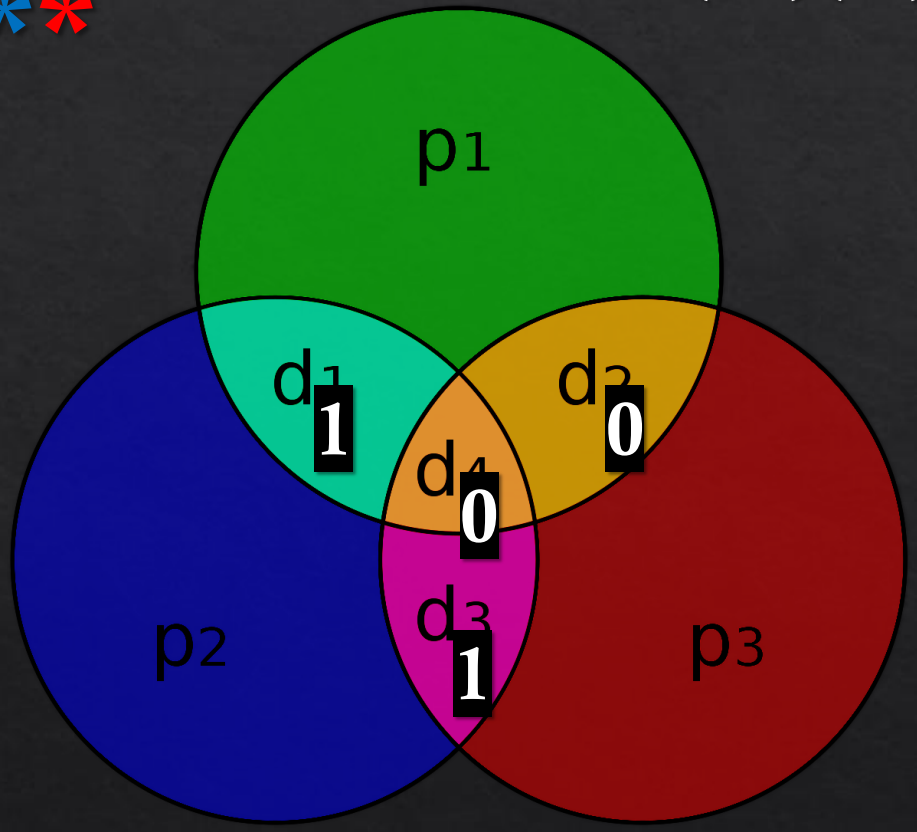
1010***



Codici di Hamming

$$(d_1)(d_2)(d_3)(d_4)(p_1)(p_2)(p_3)$$
$$(1)(0)(1)(0)(?)(?)(?)$$

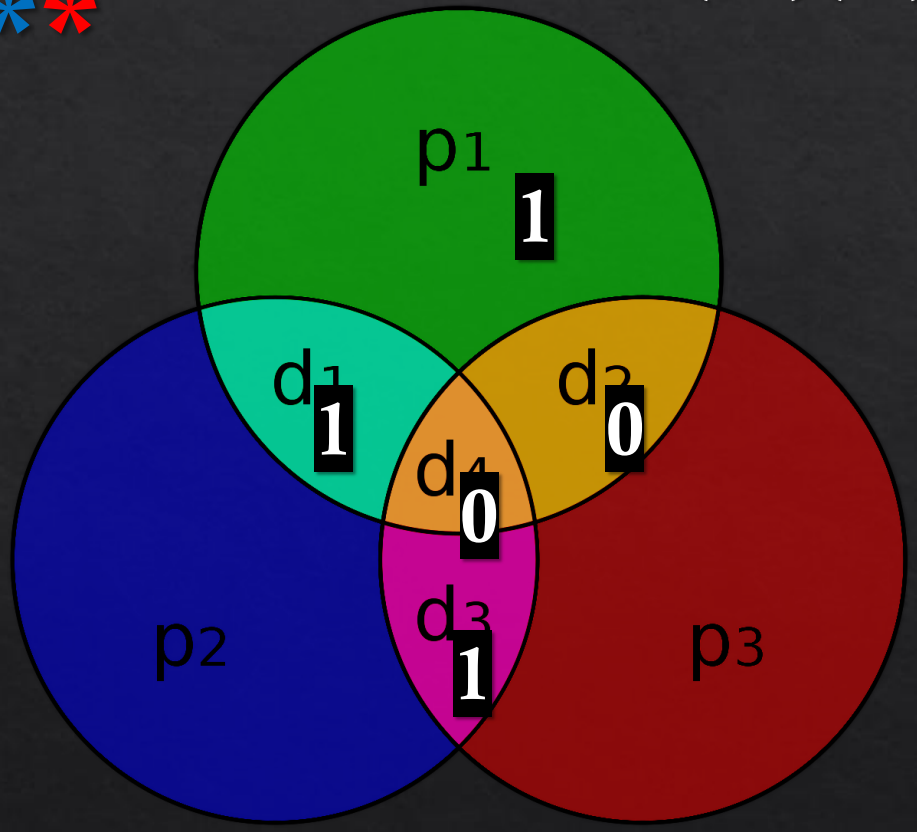
1010***



Codici di Hamming

$(d_1)(d_2)(d_3)(d_4)(p_1)(p_2)(p_3)$
$(1)(0)(1)(0)(1)(?)(?)$

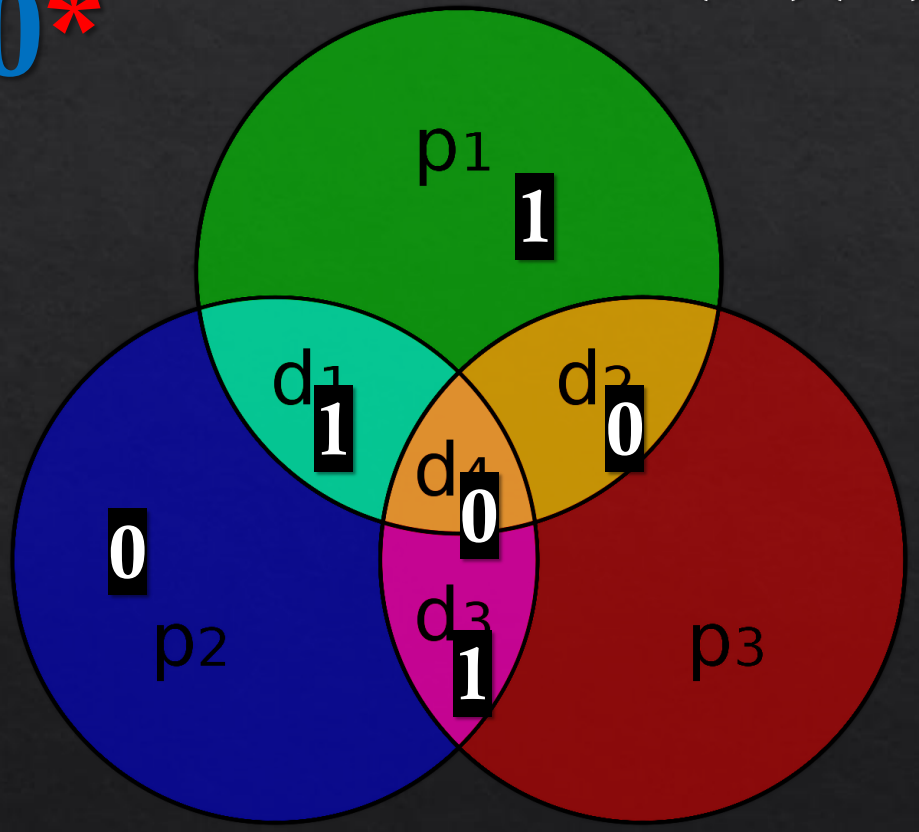
10101**



Codici di Hamming

$(d_1)(d_2)(d_3)(d_4)(p_1)(p_2)(p_3)$
$(1)(0)(1)(0)(1)(0)(?)$

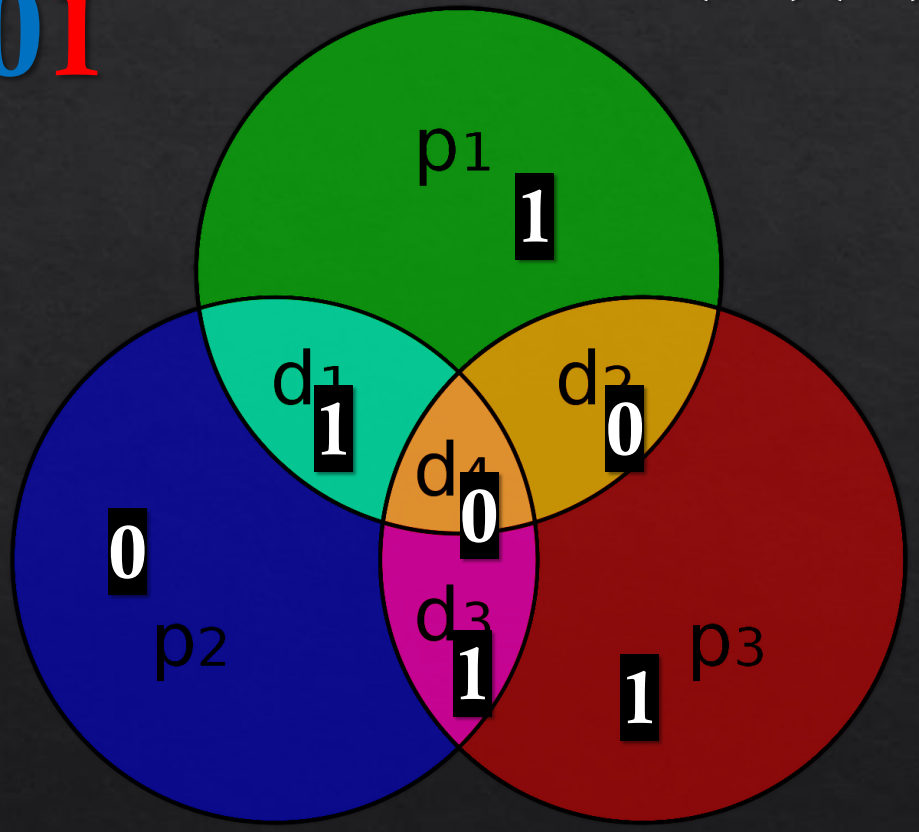
101010*



Codici di Hamming

$(d_1)(d_2)(d_3)(d_4)(p_1)(p_2)(p_3)$
$(1)(0)(1)(0)(1)(0)(1)$

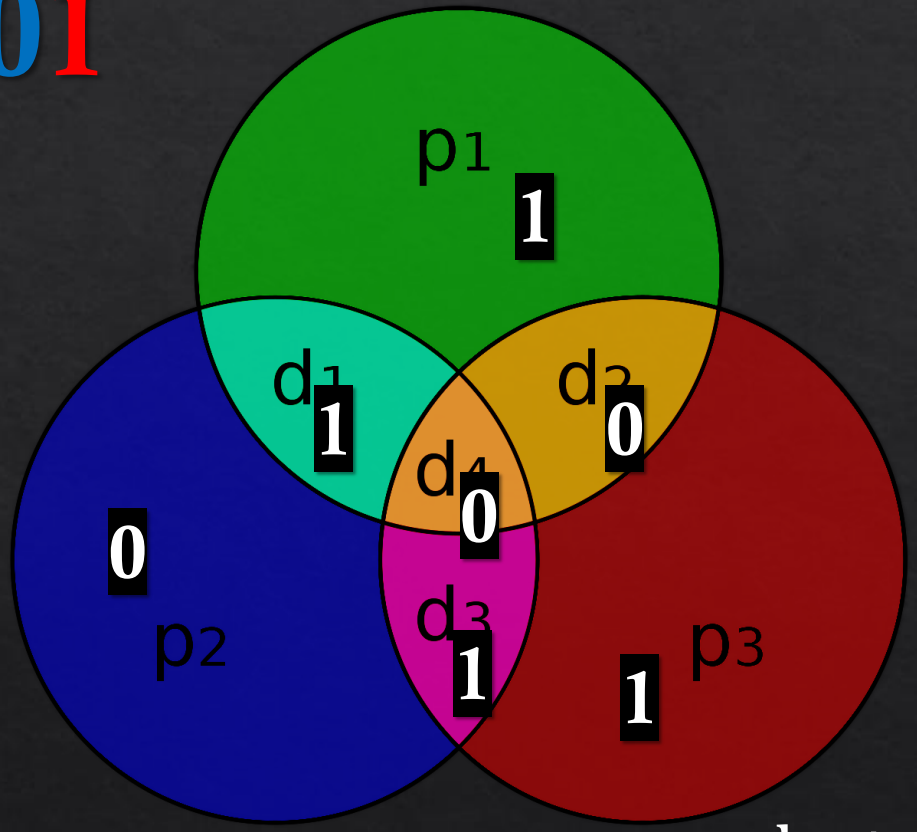
1010101



Codici di Hamming

$\mathrm{d}_1 + d_2 + d_4 + p_1$ è $pari$

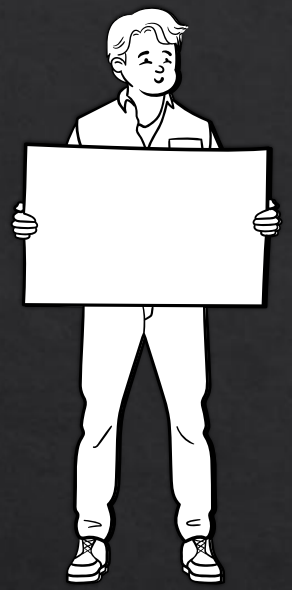
1010101

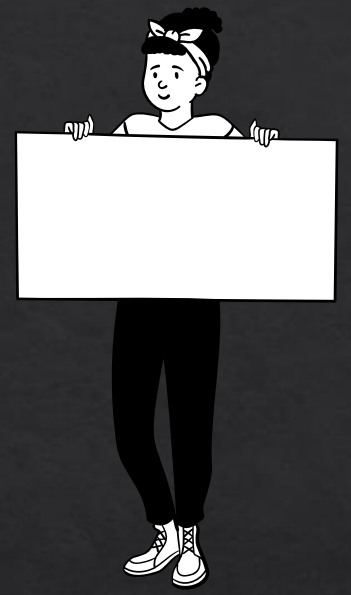


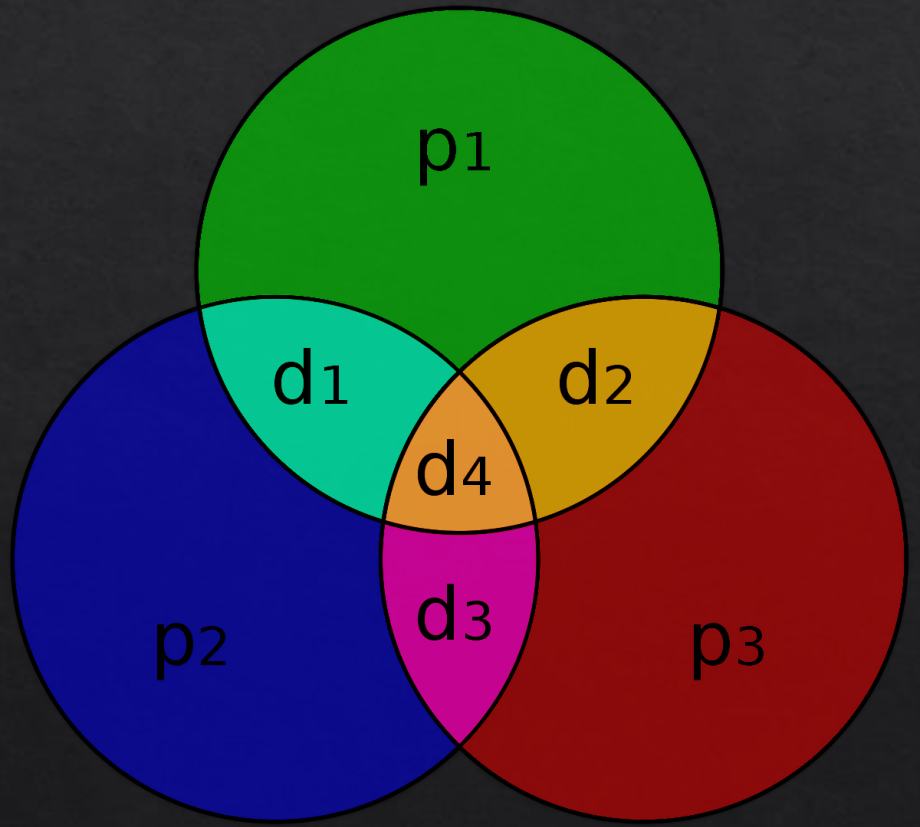
$\mathrm{d}_1 + d_3 + d_4 + p_2$ è $pari$

$\mathrm{d}_2 + d_3 + d_4 + p_3$ è $pari$

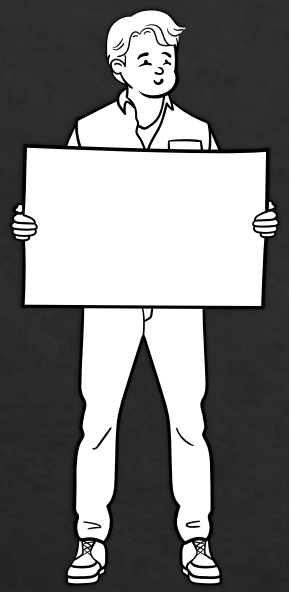
Codici di Hamming

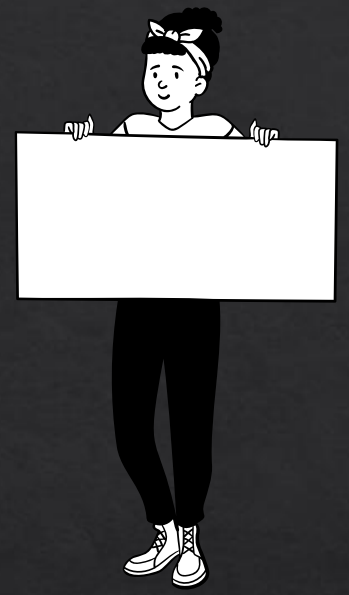


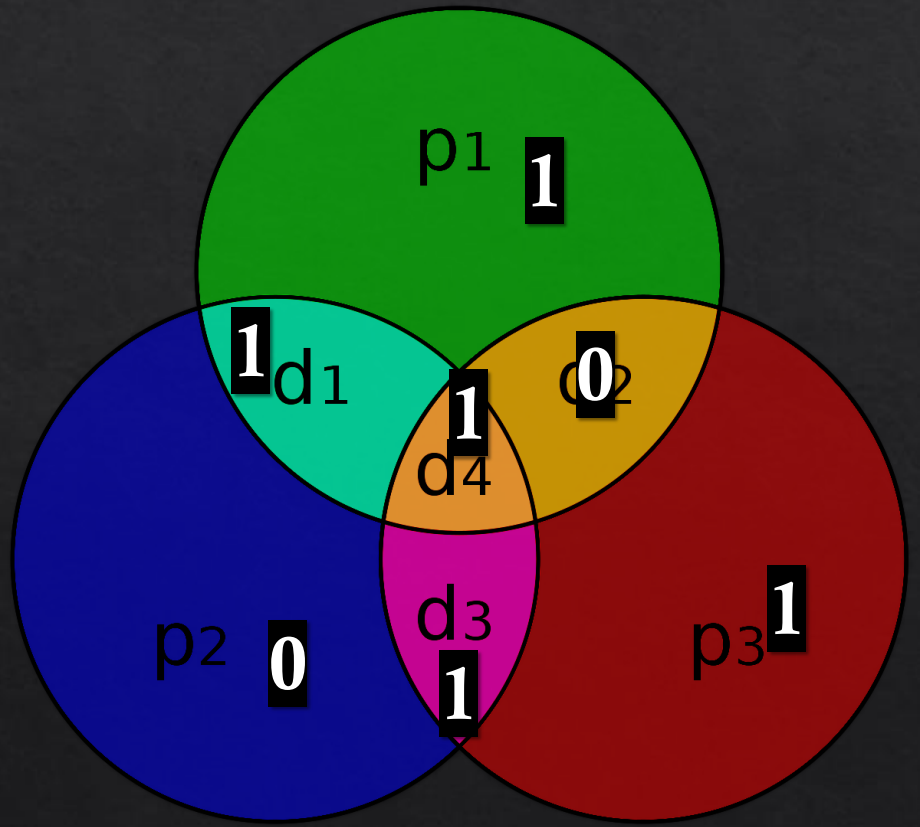




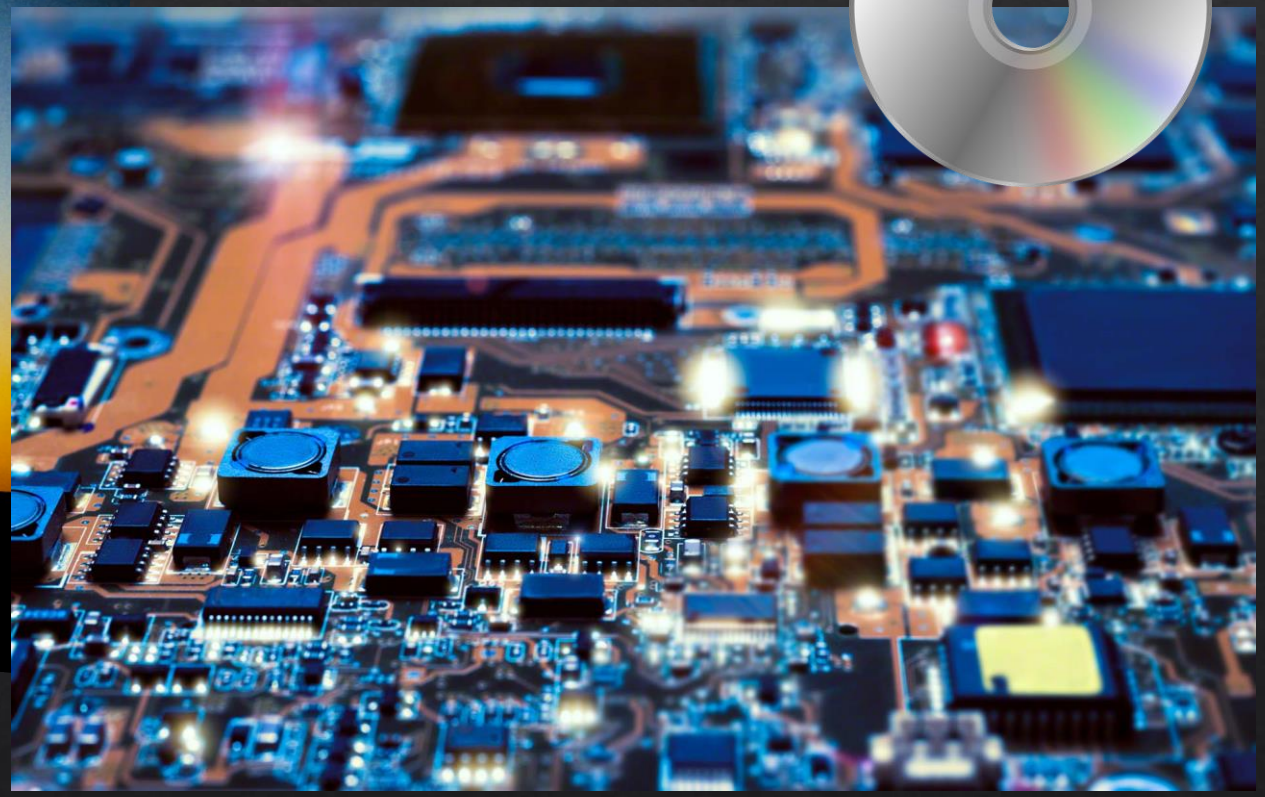
Codici di Hamming







I codici nel mondo



The transistor in your computer:

The transistor after being hit by a cosmic ray:

FIN

1. dispari (1, 3, 5, 7, 9,11,13,15)
2. maggiore di 7 (8, 9,10,11,12,13,14,15)
3. resto 2 o 3 se diviso per 4 (2, 3, 6, 7,10,11,14,15)
4. forma 4k+n per k dispari ed n < 4 (4, 5, 6, 7,12,13,14, 1)
5. ?
6. ?
7. ?