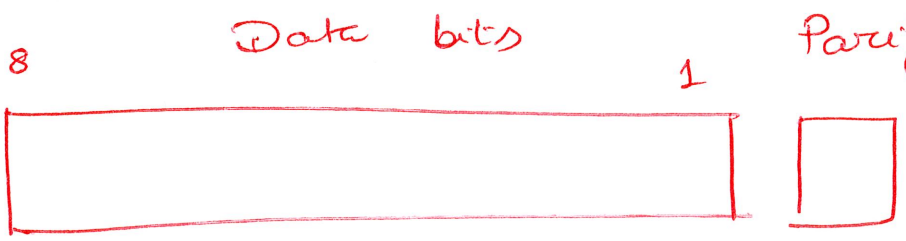
Parity coding



$$P = \bigoplus_{i=1}^{8} D_i$$

Even parity
⇒ # 1's between {D U P}
is even

#1's = 2
↓
even

#1's = 2

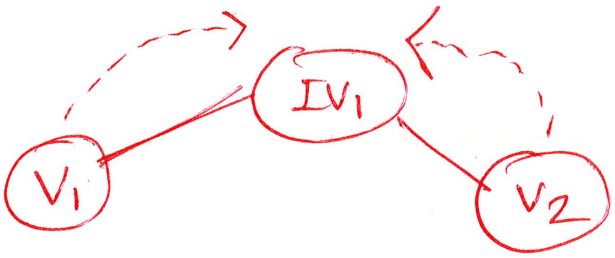
Detect any odd number of bits being in error.

Cannot correct any error.

1 bit detecting, 0 bit correcting.

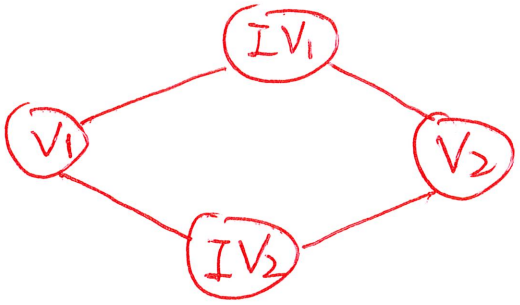
SECDED

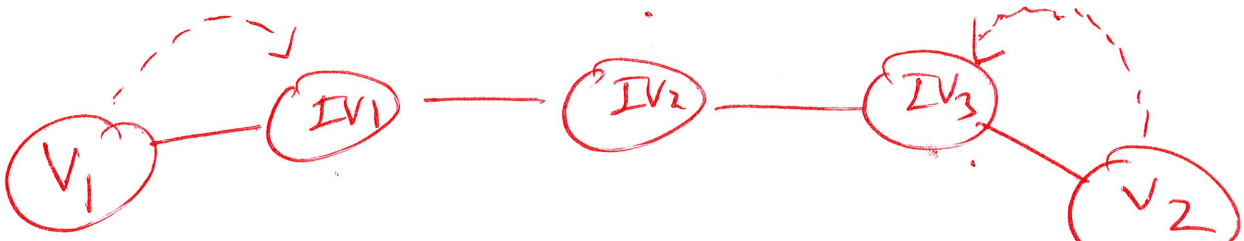
Single Error Correction Double Error Detection.



Detect 1 bit
Correct 0 bit.

Detect 2 bits
Correct 1 bit





Min distance between two valid codewords.

Consider a data word of 4 bits.
and 3 parity bits to protect these databits.

7	6	5	4	3	2	1
d_3	d_2	d_1	p_3	d_0	p_2	p_1

p_1 = XOR of bits (3, 5, 7) = XOR(d_0, d_1, d_3)

p_2 = = XOR (d_0, d_2, d_3)

p_3 = = XOR (d_1, d_2, d_3)

Sent:

7	6	5	4	3	2	1
1	0	0	1	1	0	0

↓ Error in transmission

Case 1

1	0	0	1	0	0	0

Error in transmission

case 2

1	0	0	1	1	0	1

k : # data bits

c : # coding bits

k = 4, c = 3

Correction:

For correcting one-bit errors, I need to add c coding bits to a k bit word.

Then the relation that must hold is 2^c >= c + k + 1

K data bits

(c)

How many coding bits do you need to correct all single bit errors?

You need c such that

$$2^{c} \geq c + K + 1$$

K = 4

Minimum c needed = 3.

$$2^{3} = 8 \geq 3 + 4 + 1 = 8$$