

Example: Systematic Codes

(4,3) Even Parity

❑ 8 codewords

0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Parity bits

$$c_1 = u_1$$

$$c_2 = u_2$$

$$c_3 = u_3$$

$$c_4 = u_1 + u_2 + u_3$$

(5,1) Repetition

❑ 2 codewords

0	0	0	0	0
1	1	1	1	1

Parity bits

Example: A Non-systematic Code

$$u = (u_1, u_2, u_3) \xrightarrow{\text{Encoder}} c = (c_1, c_2, c_3, c_4)$$

□ Encoding:

- $c_1 = u_1$
- $c_2 = u_1 + u_2 + u_3$
- $c_3 = u_2 + u_3$
- $c_4 = u_1 + u_2$

- ## □ It is non-systematic because u_2 and u_3 are not equal to any check bits.

Message u	Codeword c
000	0000
001	0110
010	0111
011	0001
100	1101
101	1011
110	1010
111	1100