4-7 Coding

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TJ 8-6(b,d)

In each of the following codes, what is the minimum distance for the code? What is the best situation we might hope for in connection with error detection and error correction?

(b)

$$(011100)(011011)(111011)(100011)$$
$$(000000)(010101)(110100)(110011)$$

(d)

$$(0110110)(0111100)(1110000)(1111111)$$
$$(1001001)(1000011)(0001111)(0000000)$$

(b)

	(011100)	(011011)	(111011)	(100011)	(000000)	(010101)	(110100)	(110011)
(011100)	0	3	4	6	3	2	2	5
(011011)	3	0	1	3	4	3	5	2
(111011)	4	1	0	2	5	4	4	1
(100011)	6	3	2	0	3	4	4	1
(000000)	3	4	5	3	0	3	3	4
(010101)	2	3	4	4	3	0	2	3
(110100)	2	5	4	4	3	2	0	3
(110011)	5	2	1	1	4	3	3	0

$$d_{min} = 1$$

(d)

	(011100)	(011011)	(111011)	(100011)	(000000)	(010101)	(110100)	(110011)
(011100)	0	3	4	6	3	2	2	5
(011011)	3	0	1	3	4	3	5	2
(111011)	4	1	0	2	5	4	4	1
(100011)	6	3	2	0	3	4	4	1
(000000)	3	4	5	3	0	3	3	4
(010101)	2	3	4	4	3	0	2	3
(110100)	2	5	4	4	3	2	0	3
(110011)	5	2	1	1	4	3	3	0

$$d_{min} = 2$$

TJ 8-7(c,d)

Compute the null space of each of the following matrices. What type of (n, k)-block codes are the null spaces? Can you find a matrix (not necessarily a standard generator matrix) that generates each code? Are your generator matrices unique?

(c)

$$\begin{pmatrix} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

(d)

$$\begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

(c)

$$\begin{pmatrix} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

- **Null(H)**:
  (00000) (00100) (11010) (11110) (11001) (11101) (00011) (00111)
- (5,3)-block
- **Generator**:

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

(d)

$$\begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

- **Null(H)**:

  (0000000)(0001111)(0010110)(0011001)

  (0100101)(0101010)(0110011)(0111100)

  (1000011)(1001100)(1010101)(1011010)

  (1100110)(1101001)(1110000)(1111111)

- (7,4)-block

- **Generator**:

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

TJ 8-9

9. Let C be the code obtained from the null space of the matrix

$$H = \begin{pmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 \end{pmatrix}.$$

Decode the message

$$01111 \quad 10101 \quad 01110 \quad 00011$$

if possible.


Thank
You!