

SC 561

FALL 99

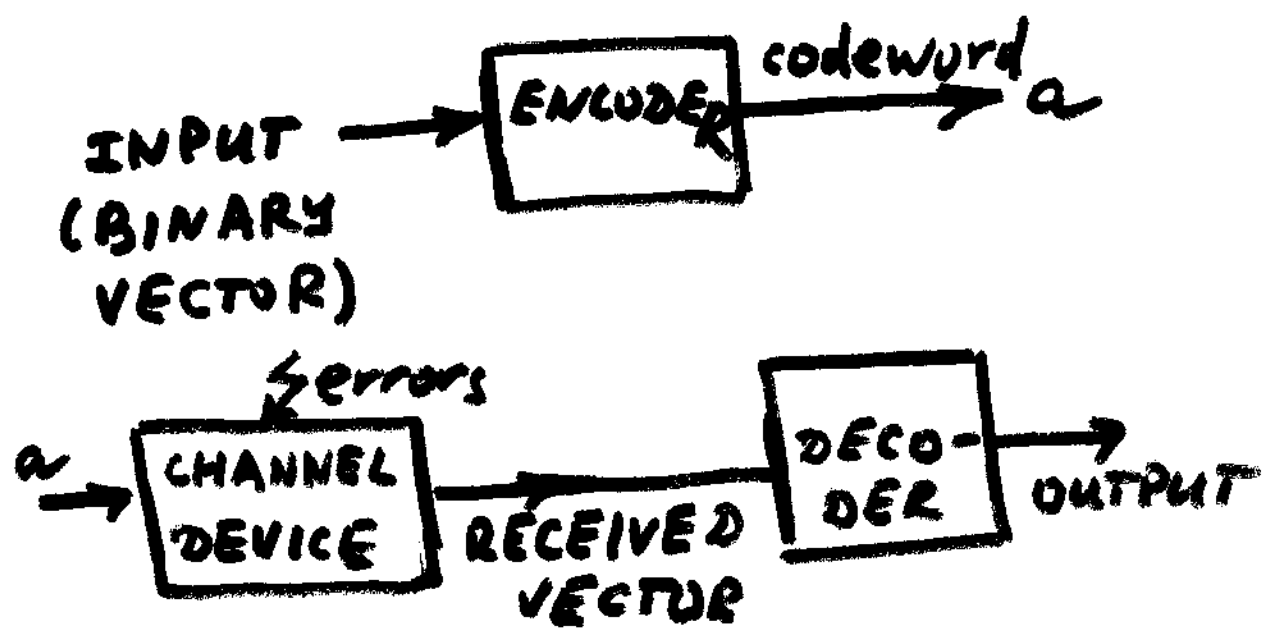
THEORY OF ERROR

CORRECTING CODES

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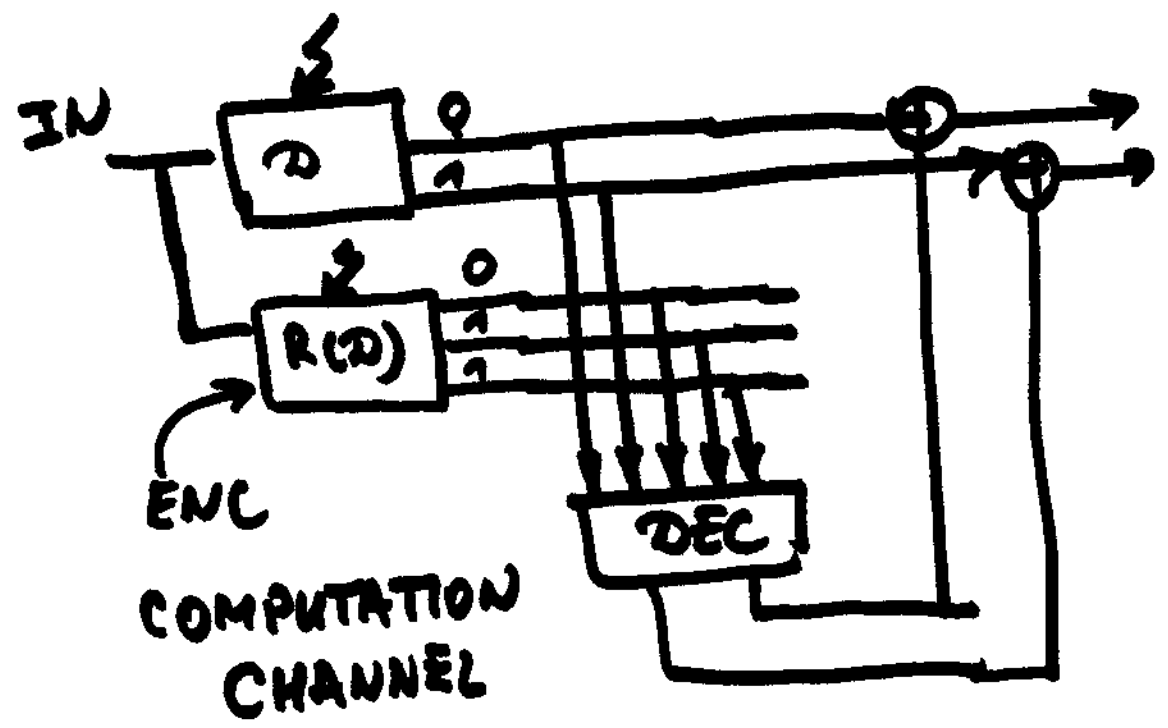
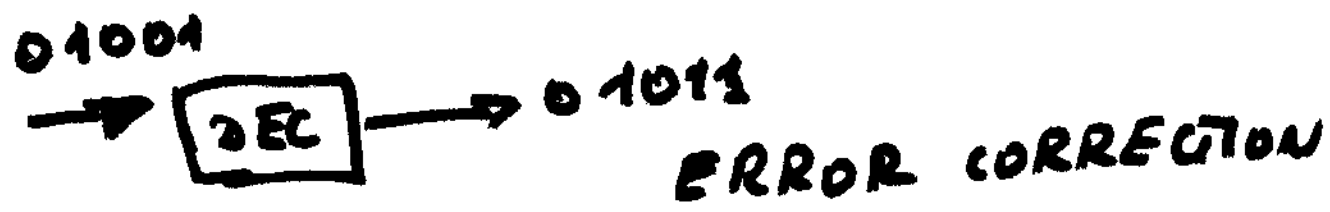
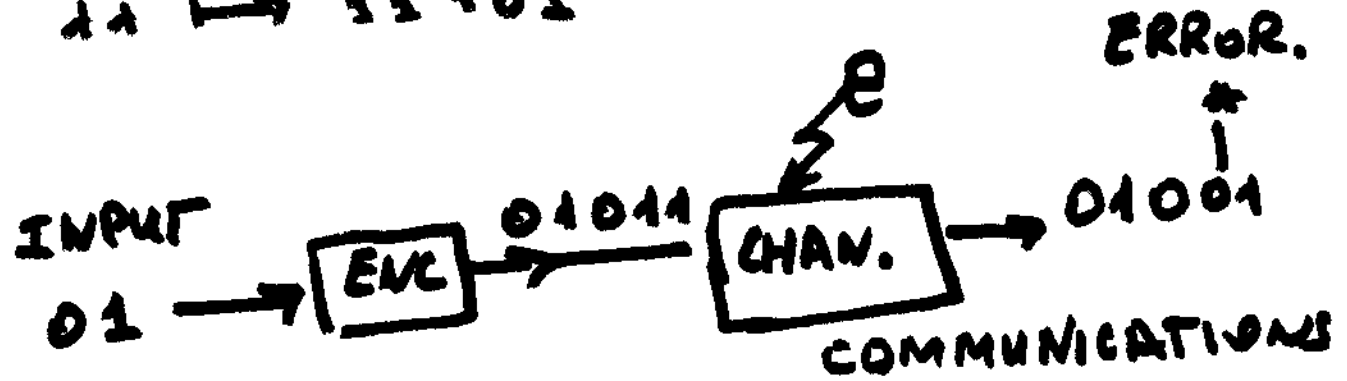
TEXT: R. HILL, "A FIRST COURSE
IN CODING THEORY"
CLARENDON PRESS, 1986.

MATHEMATICAL THEORY OF DETECTION, LOCATION AND CORRECTION OF ERRORS IN COMPUTERS AND COMMUNI- CATION CHANNELS.



EXAMPLE : ENCODER (ENC)

00	→	00000
01	→	01011
10	→	10110
11	→	11101



• ERROR CORRECTION MAY ALSO BE OBTAINED BY ERROR DETECTION AND RETRANSMISSION OR RECOMPUTING.

CHANNELS



If for error-free case $f(x) = x$, then CH is a communication channel

EXAMPES OF COMMUNICATION^{4.}

CHANNELS: COMMUNICATION
LINKS, memories

If $f(x) \neq x$, then CH. is
a computation channel

(computer components: adders,
multipliers, etc.).

Notation: $Z_2 = \{0, 1\}$

$Z_q = \{0, 1, 2, \dots, q-1\}$

Z_q^n - set of all q -ary vectors
of length n .

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Example $Z_2^2 = \{00, 01, 10, 11\}$

$Z_3^2 = \{00, 01, 02, 10, 11, 12, 20, 21, 22\}$

$Z_2^3 = \{000, 001, 010, 011, 100, 101, 110, 111\}$

Definition: A q -ary code C of length n is any subset of Z_q^n ($C \subseteq Z_q^n$)

EXAMPLE $C = \{00000, 01011, 10110, 11101\}$
is a binary code of length 5.

EXAMPLE. A SET OF ALL TELEPHONE NUMBERS IN USA AND CANADA is a DECIMAL (10-ARY) CODE OF LENGTH $n=10$.