LECTURE 4

ERROR DETECTION AND CORRECTION

Example 1

Suppose the sender wants to send the word *world*. In ASCII the five characters are coded as

1110111 1101111 1110010 1101100 1100100

The following shows the actual bits sent

11101110 11011110 11100100 11011000 11001001

Example 2

Now suppose the word world in Example 1 is received by the receiver without being corrupted in transmission.

11101110 11011110 11100100 11011000 11001001

The receiver counts the 1s in each character and comes up with even numbers (6, 6, 4, 4, 4). The data are accepted.

Example 3

Now suppose the word world in Example 1 is corrupted during transmission.

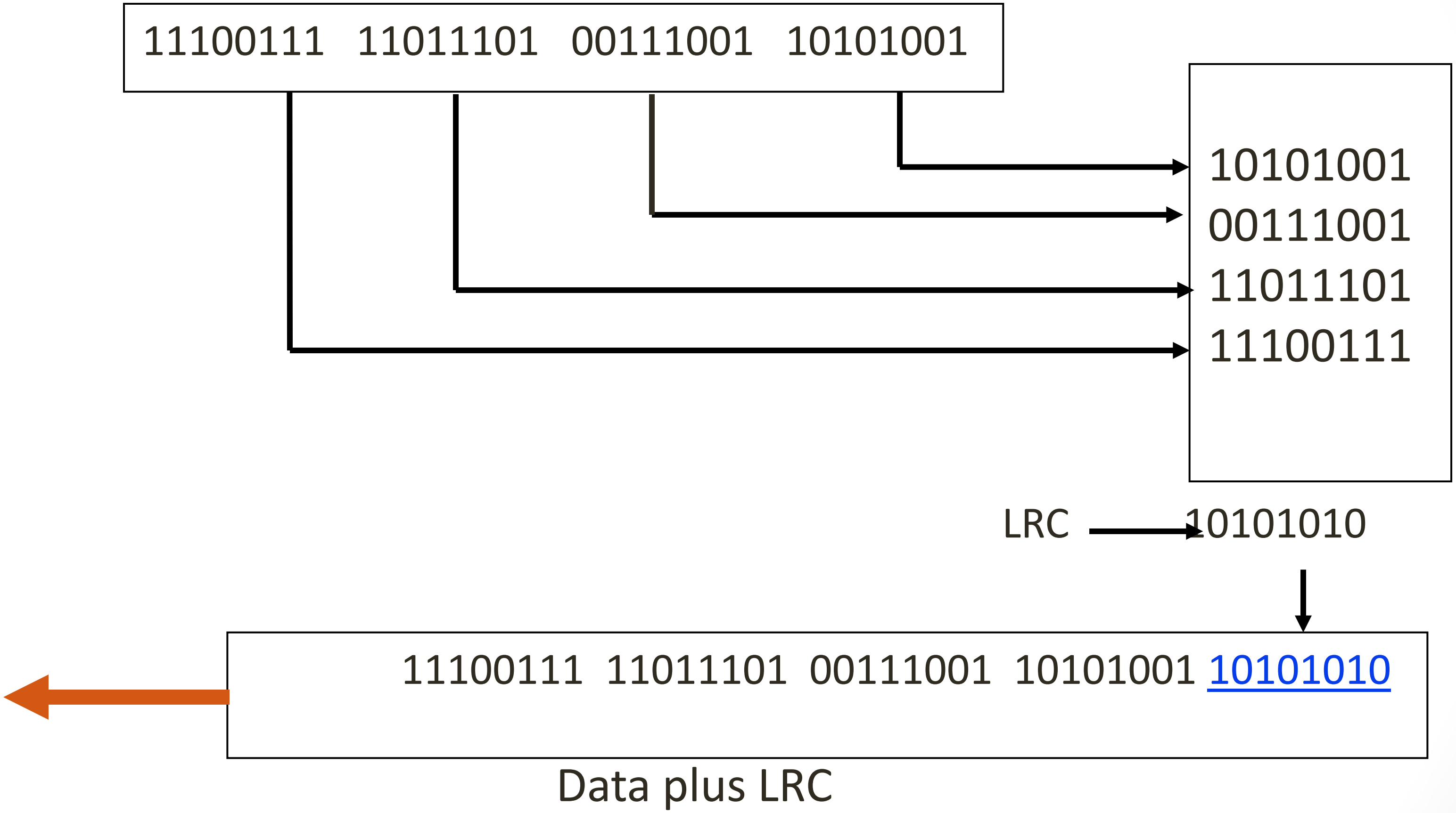
11111110 11011110 11101100 11011000 11001001

The receiver counts the 1s in each character and comes up with even and odd numbers (7, 6, 5, 4, 4). The receiver knows that the data are corrupted, discards them, and asks for retransmission.

Note:

Simple parity check can detect all single-bit errors. It can detect burst errors only if the total number of errors in each data unit is odd.

LONGITUDINAL REDUNDANCY CHECK
LRC



11100111 11011101 00111001 10101001

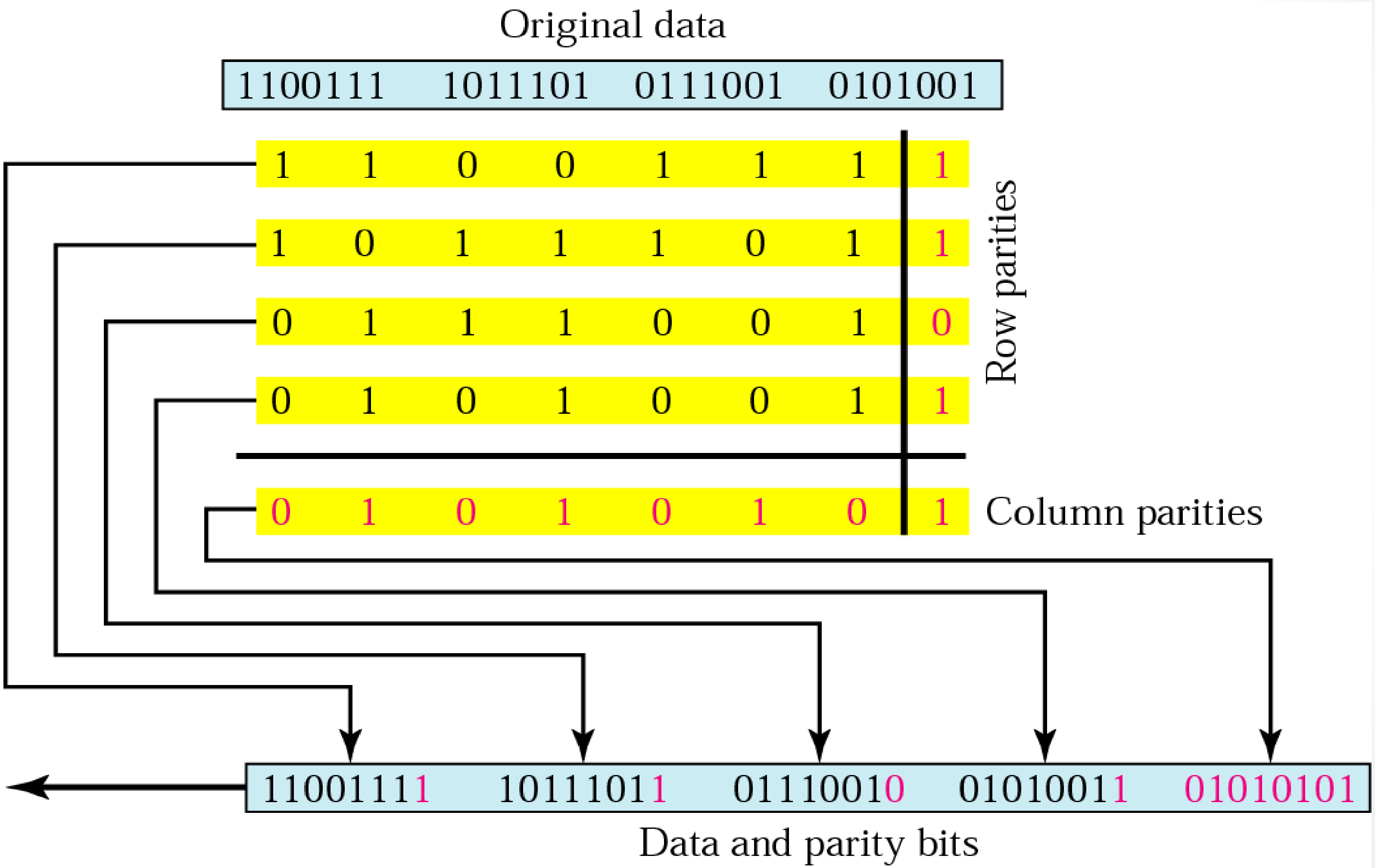
10101001
00111001
11011101
11100111

LRC 10101010

11100111 11011101 00111001 10101001 10101010

Data plus LRC

Two-dimensional parity



Original data

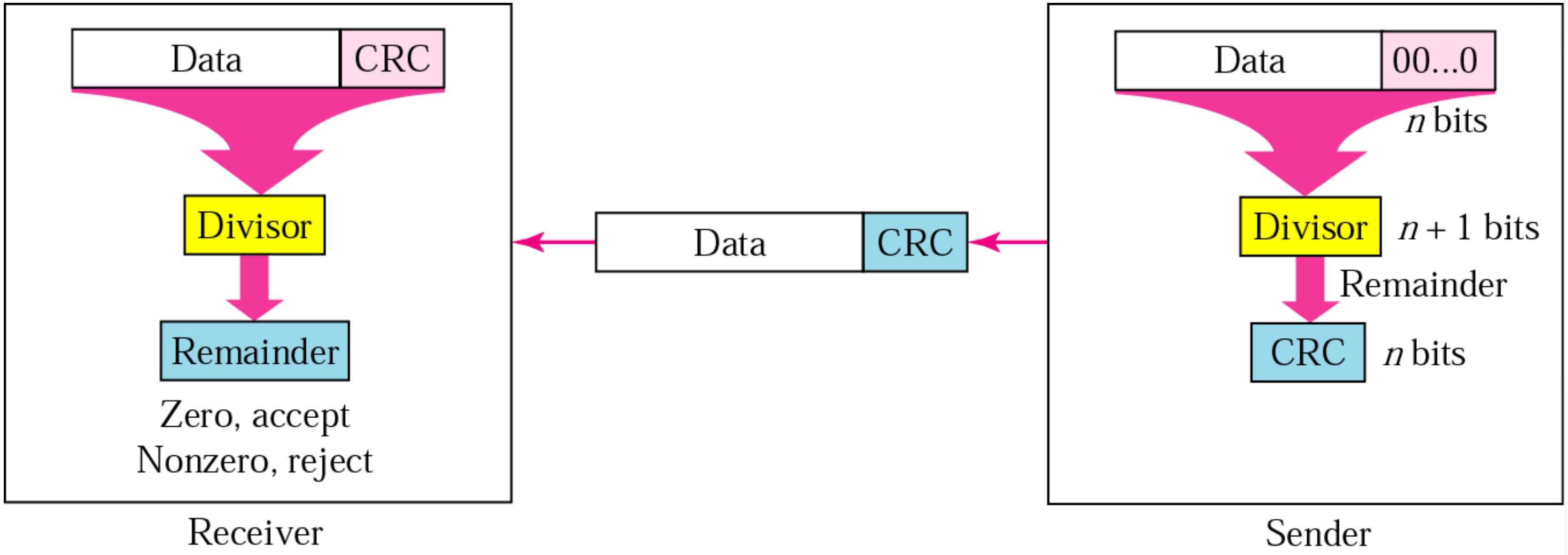
1100111 1011101 0111001 0101001

1	1	0	0	1	1	1	1	Row parities
1	0	1	1	1	0	1	1	
0	1	1	1	0	0	1	0	
0	1	0	1	0	0	1	1	
0	1	0	1	0	1	0	1	Column parities

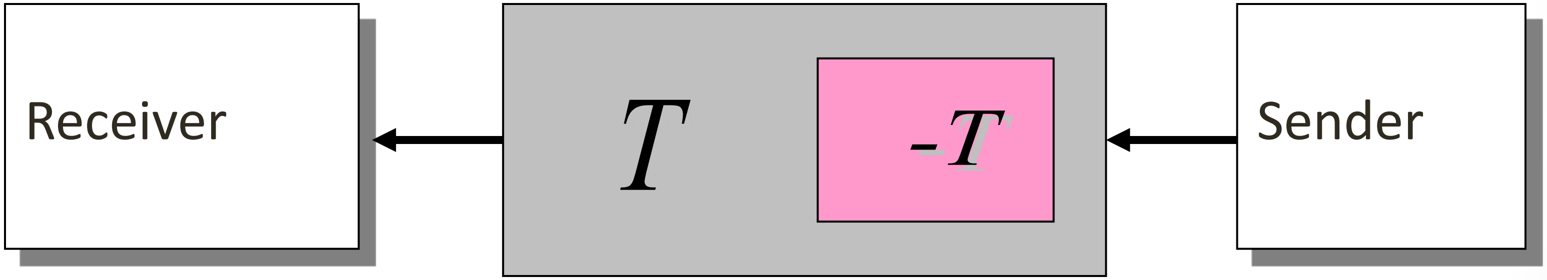
11001111 10111011 01110010 01010011 01010101

Data and parity bits

CRC generator and checker



Data unit and checksum



Note:

The sender follows these steps:

- The unit is divided into k sections, each of n bits.
- All sections are added get the sum.
- The sum is complemented and becomes the checksum.
- The checksum is sent with the data.

Note:

The receiver follows these steps:

- ➢The unit is divided into k sections, each of n bits.
- ➢All sections are added to get the sum.
- ➢The sum is complemented.
- ➢If the result is zero, the data are accepted: otherwise, rejected.