CS & IT ENGINEERING

COMPUTER NETWORKS

Error Control

Lecture No-4

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- Simple Parity
- 2D Parity

Error control

Error detection

1. Simple Parity
2. 2D Parity
3. CRC
4. checksum

Error correction

Hamming code

Simple Parity Check Code

Simple parity :

- In the Simple parity concept one extra bit (parity bit) is added to each dataword.
- Simple parity check can detect all single bit error .
- Simple parity check can not detect an even number of errors.
- Simple parity check can detect an odd number of errors .

Simple Parity

even parity	Odd Parity
No. of 1's must be even in each code word including the Parity bit	No. of 1's must be odd in each code word including the Parity bit

Message : 00 | 01 | 10 | 11

even Parity

dataword , $K = 2$, $r = 1$, $n = K + r = 2 + 1 = 3$

Dataword	Code word
00	000
01	011
10	101
11	110

(i)

No. of 1's = odd

Receiver can detect one bit error

(ii)

No. of 1's = even

Receiver can not detect 2 bit error

(iii)

No. OF 1's = odd

Receiver can detect 3 bit error

2D Parity Check Code

2D parity :

- Two dimensional parity check can detect and correct all single bit error and detect two or three bit error that occur any where in the matrix
- However only some pattern with four or more Error can be detected.
- In a 2D-parity check code, the information bits are organized in a matrix consisting of row and columns.
- For each row and each column one parity check bits is calculated.

Original Data OR Message

1st row	2nd row	3rd row	4th row	5th row
0 1 0 0 1 0	0 1 0 1 0 1	1 0 0 1 0 1	1 1 1 0 1 1	0 0 1 0 0 1

By using even Parity

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

Row Parity

Column Parity

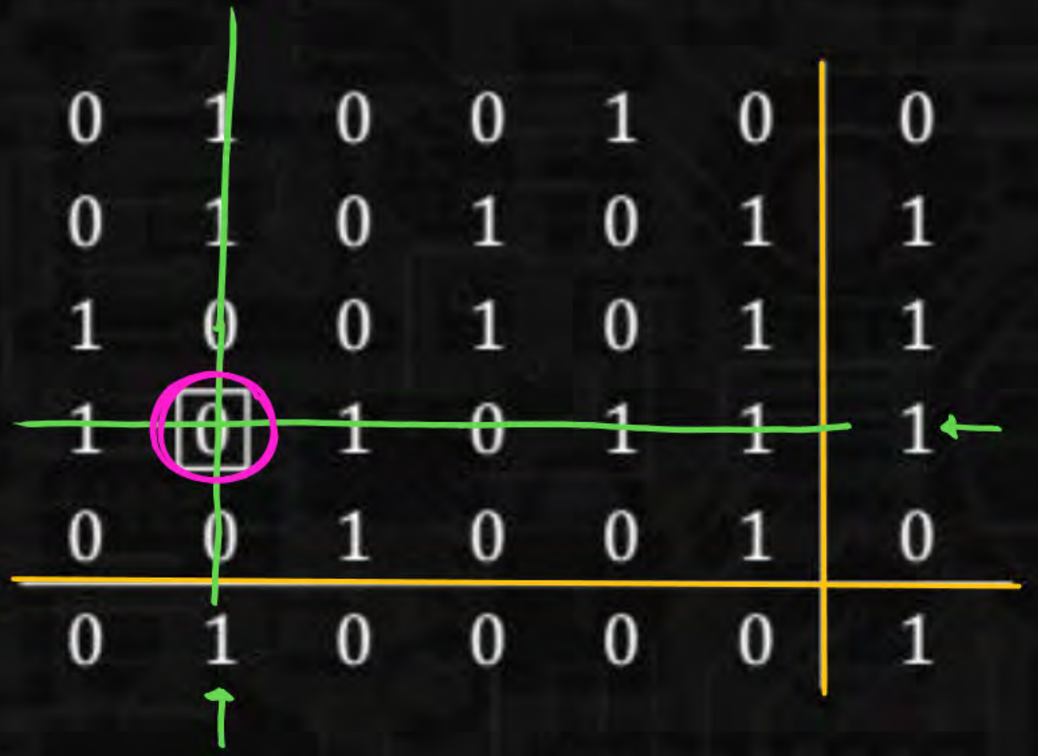
No. of row's = 5

No. of Columns = 6

Transmitted data:

0100 100	0101011	1001011	1110111	00100010	0100001
1st row	2nd row	3rd row	4th row	5th row	6th row

One Error :



① one bit error can be detected as well as corrected

② one bit error will effect 2 Parity bits

Two - Error :

0	1	0	0	1	0	0
0	1	0	**0**	0	1	1 ←
1	0	0	1	0	1	1
1	**0**	1	0	1	1	1 ←
0	0	1	0	0	1	0
0	1	0	0	0	0	1
	↑		↑			

① Gt can detect 2 bit error but Gt can not correct 2 bit error

② 2 bit error will effect maximum 4 Parity bits

③ 2 bit error will effect minimum 2 Parity bits

Two - Error :

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

3 - Error :

0	1	0	0	[0]	0	0 ←
0	[0]	0	1	0	1	1 ←
1	0	0	1	0	1	1
1	1	[0]	0	1	1	1 ←
0	0	1	0	0	1	0
0	1	0	0	0	0	

① gt can detect 3 bit error but gt can not correct 3 bit error

② 3 bit error will effect maximum 6 Parity bit

3 - Error :

0	1	0	0	1	0	0
0	[0]	0	[0]	0	1	1
1	0	0	1	0	1	1
1	[0]	1	0	1	1	1 ←
0	0	1	0	0	1	0
0	1	0	0	0	0	
			↑			

Note:

3 bit error will effect minimum 2 Parity bits

4 - Error :

0	1	0	0	1	0	0
0	[0]	0	[0]	0	1	1
1	0	0	1	0	1	1
1	[0]	1	[1]	1	1	1
0	0	1	0	0	1	0
0	1	0	0	0	0	1

It can not detect 4 bit error

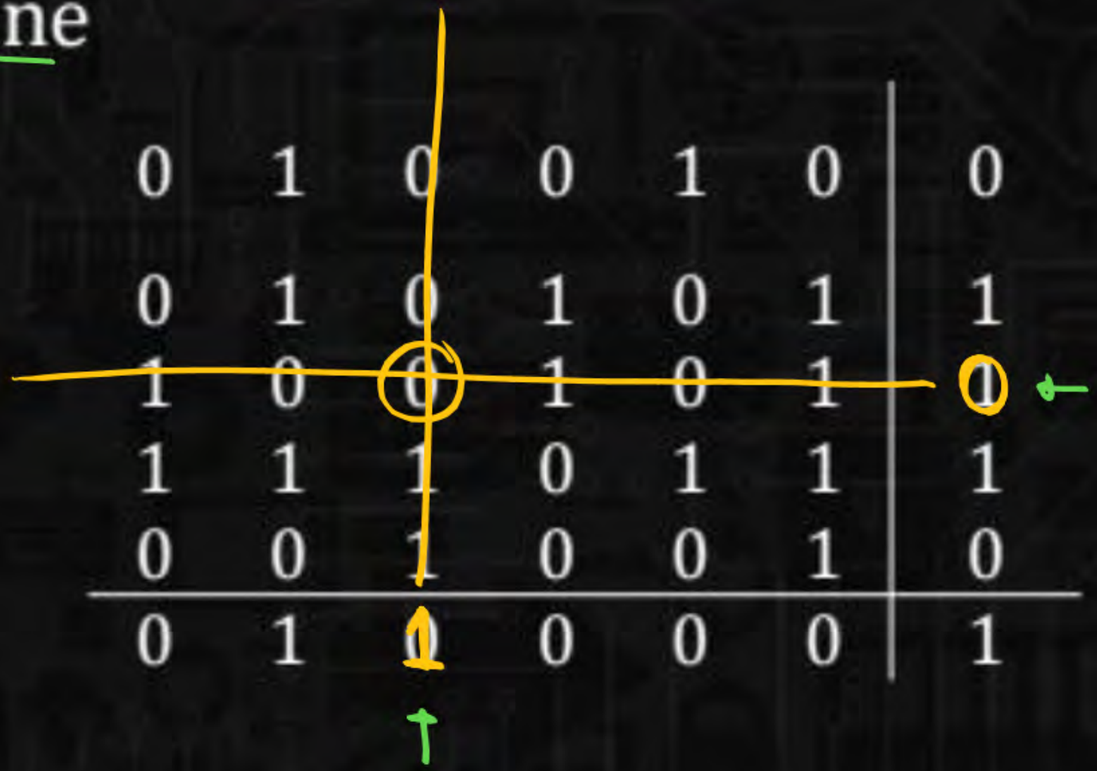
0	[0]	0	0	1	0	0 ←
0	1	[1]	1	0	1	1 ←
1	0	0	[0]	0	1	1 ←
1	1	1	0	[0]	1	1 ←
0	0	1	0	0	1	0
0	1	0	0	0	0	1

↑ ↑ ↑ ↑

4 bit error detected

Disadvantage of 2D parity :

If we have a error in the parity then this scheme does not work fine



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


THANK YOU
GW
SOLDIERS !