Error Detection Techniques

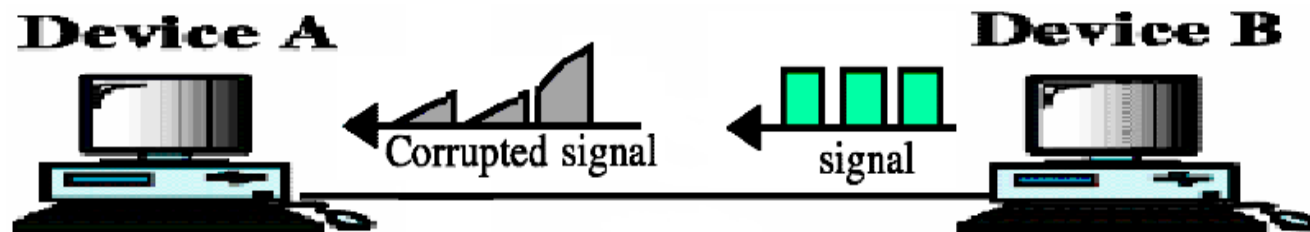**MSc Student :   Ahmed Radif**
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Outline

1- Definition

2- Type of Errors

3- Redundancy
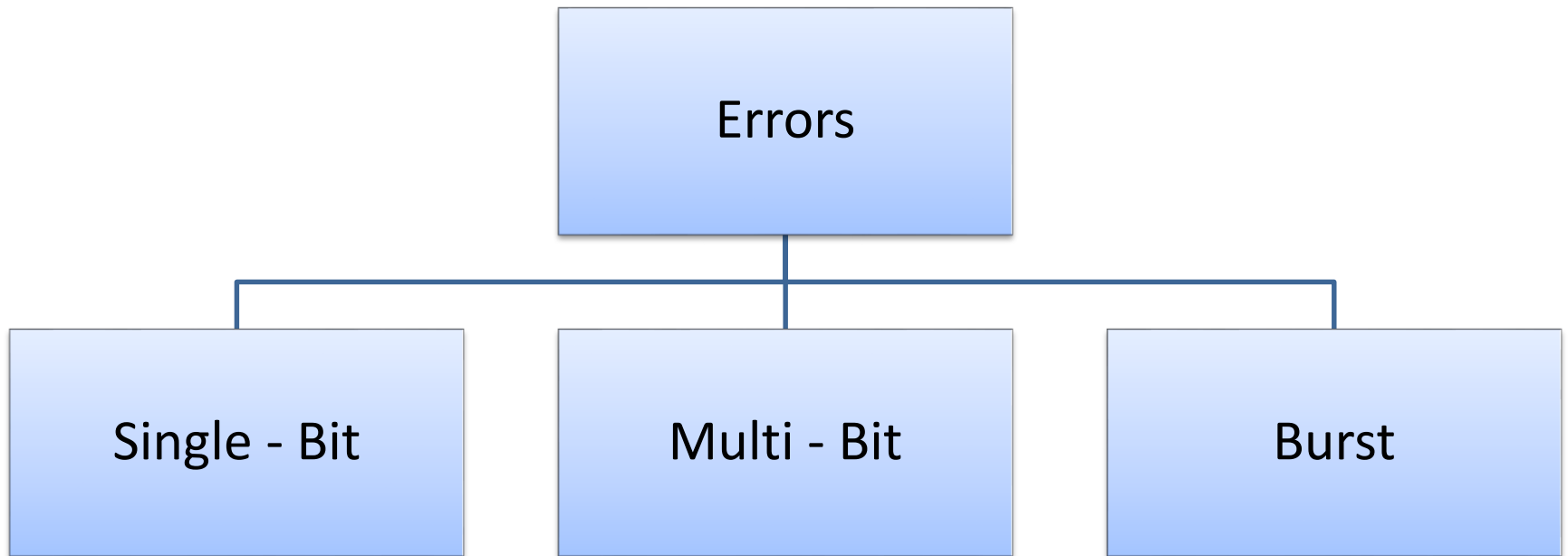
4- Detection Methods

Definition :

Network must be able to transfer data from device to another with acceptable accuracy

Data can be corrupted during transmission. For reliable communication, error must be detected and corrected
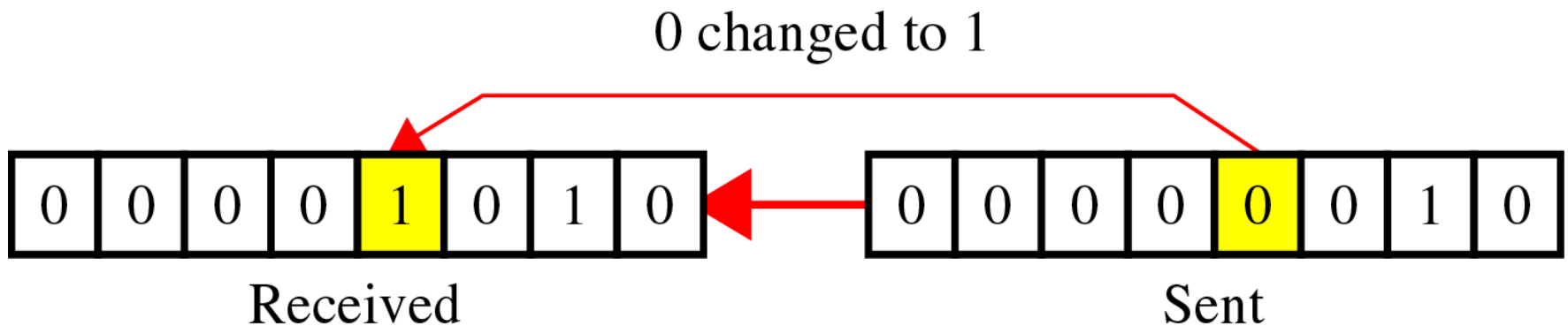
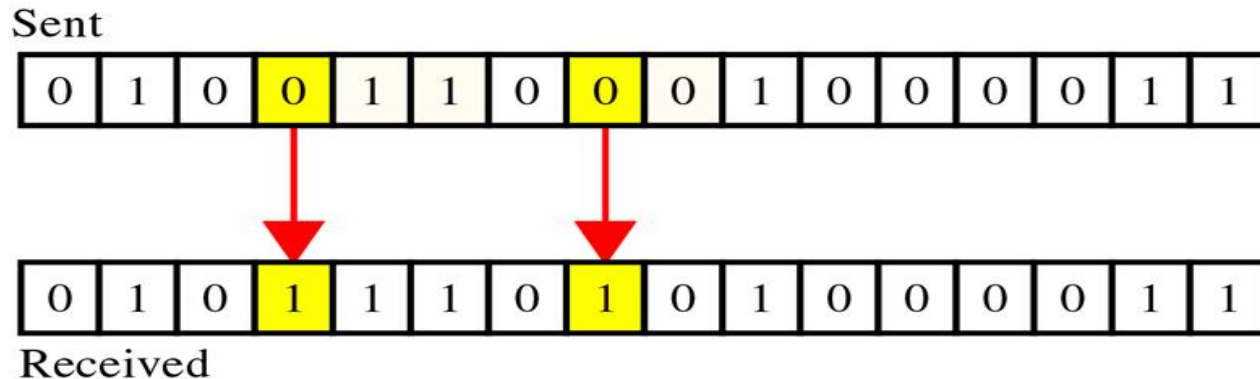**Device A** ← Corrupted signal ← signal **Device B**

Type of Errors :

```
                    ┌─────────────┐
                    │   Errors    │
                    └──────┬──────┘
         ┌─────────────────┼─────────────────┐
   ┌───────────┐     ┌───────────┐     ┌───────────┐
   │ Single-Bit│     │ Multi-Bit │     │   Burst   │
   └───────────┘     └───────────┘     └───────────┘
```

1- Single-Bit Error :

In single –bit error only one bit has changed such as (0 to 1) or (1 to 0)

0 changed to 1

| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |

Received

| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

Sent

2- Multi-Bit Error : Two or more nonconsecutive bits in a data unit have changed from (1 to 0) or (0 to 1) .

Sent

| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

| 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

Received

3- Burst Error: Two or more consecutive bits in a data unit have changed from (1 to 0) or (0 to 1) .

Sent

| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

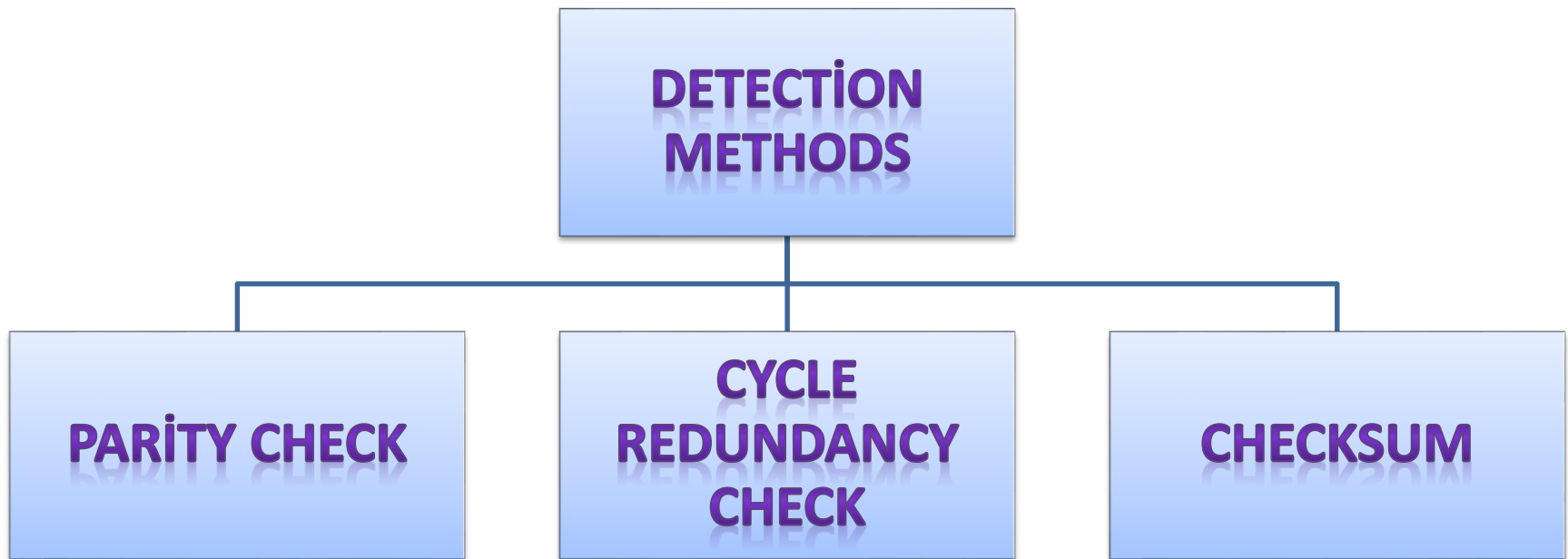| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

Received
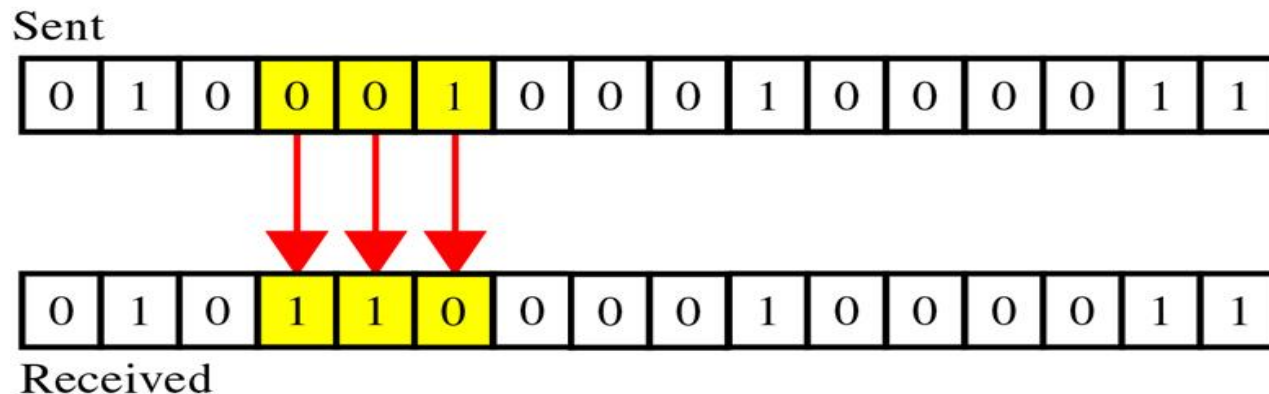
Redundancy :

*Error detection uses the concept of **Redundancy**, which means <u>adding extra bits</u> <u>for detecting errors at the destination.</u>*
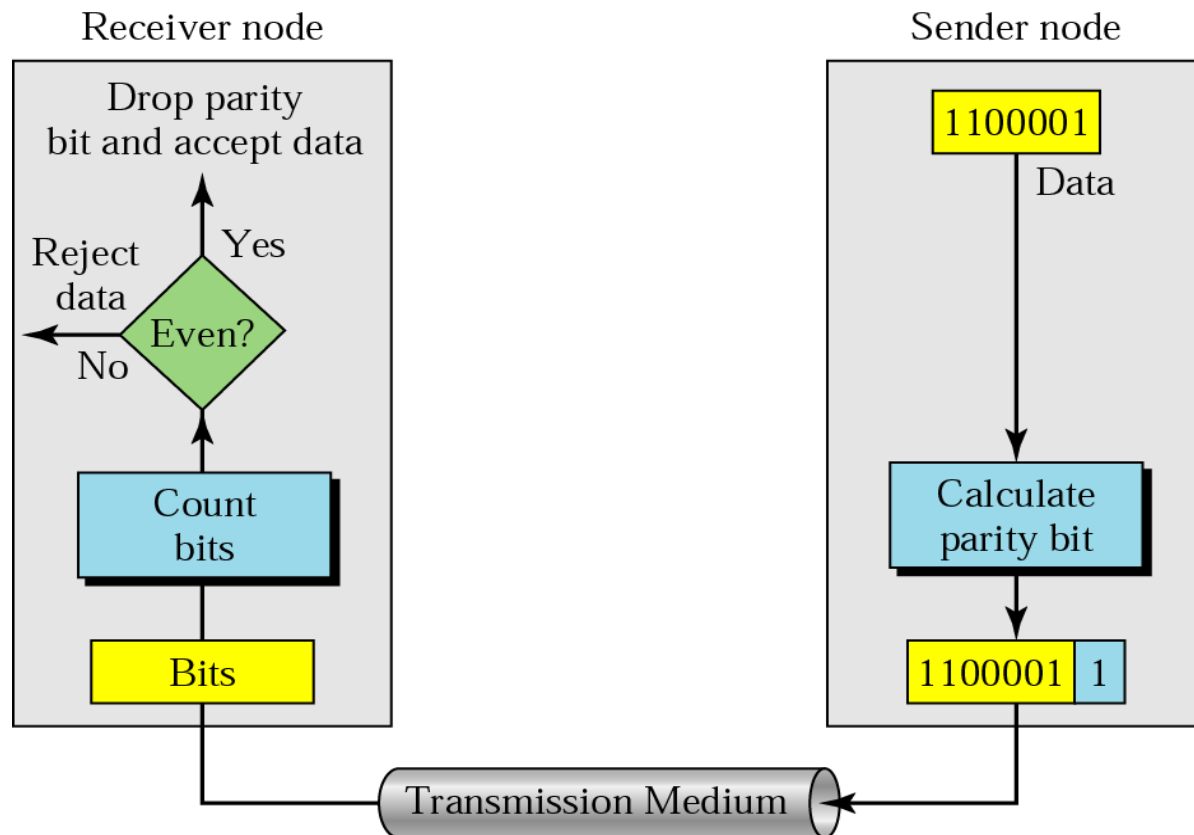

Receiver node

```
1010000000101010   Data
```

Yes

Reject data

OK?

No

```
1010000000101010 1011101
```

Data &
redundancy

Sender node

```
Data  1010000000101010
```

```
1010000000101010 1011101
```

Data &
redundancy

Medium
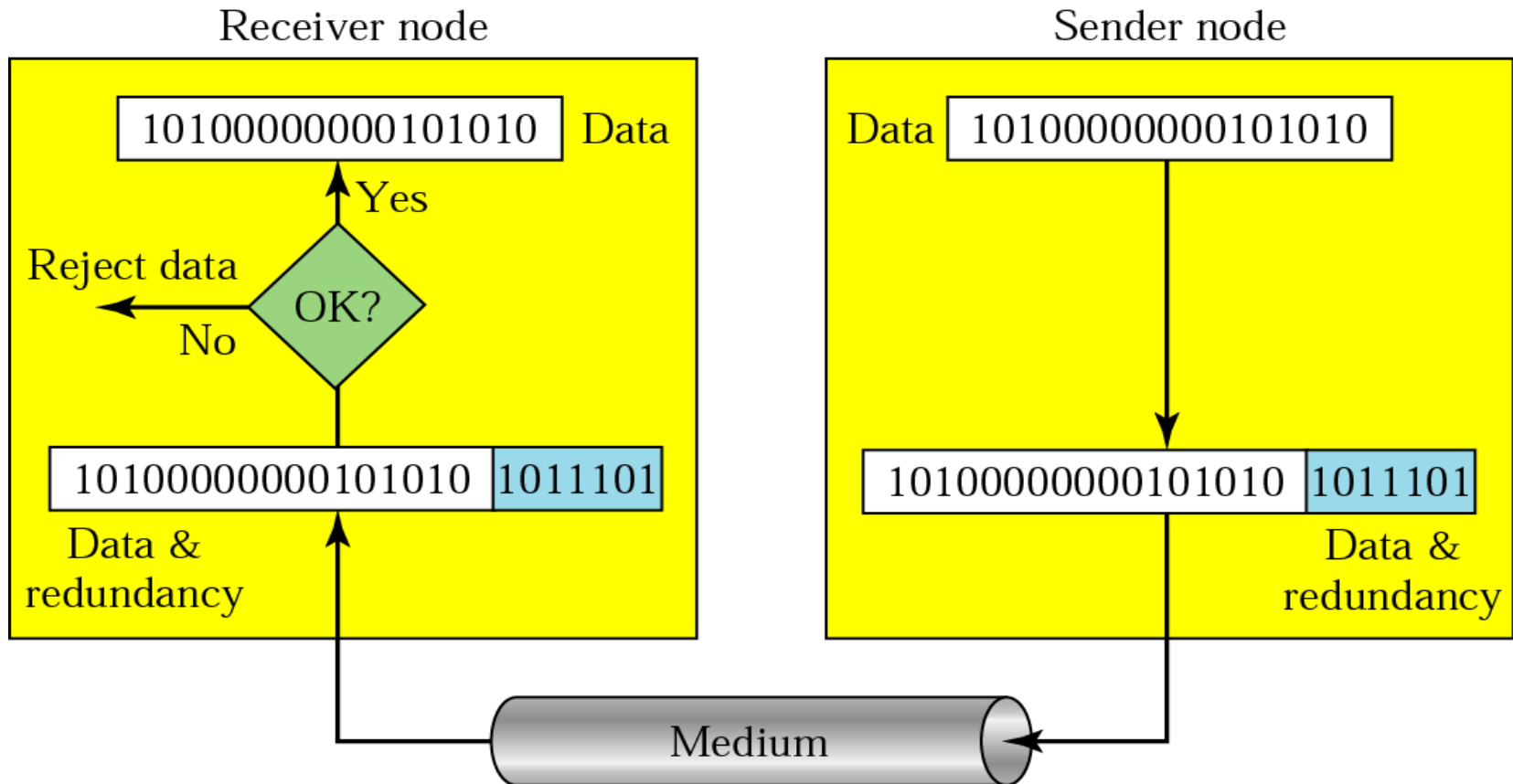
Detection Methods :

1- Parity Check : The most common and least expensive .

There are tow types :

A- Simple parity check
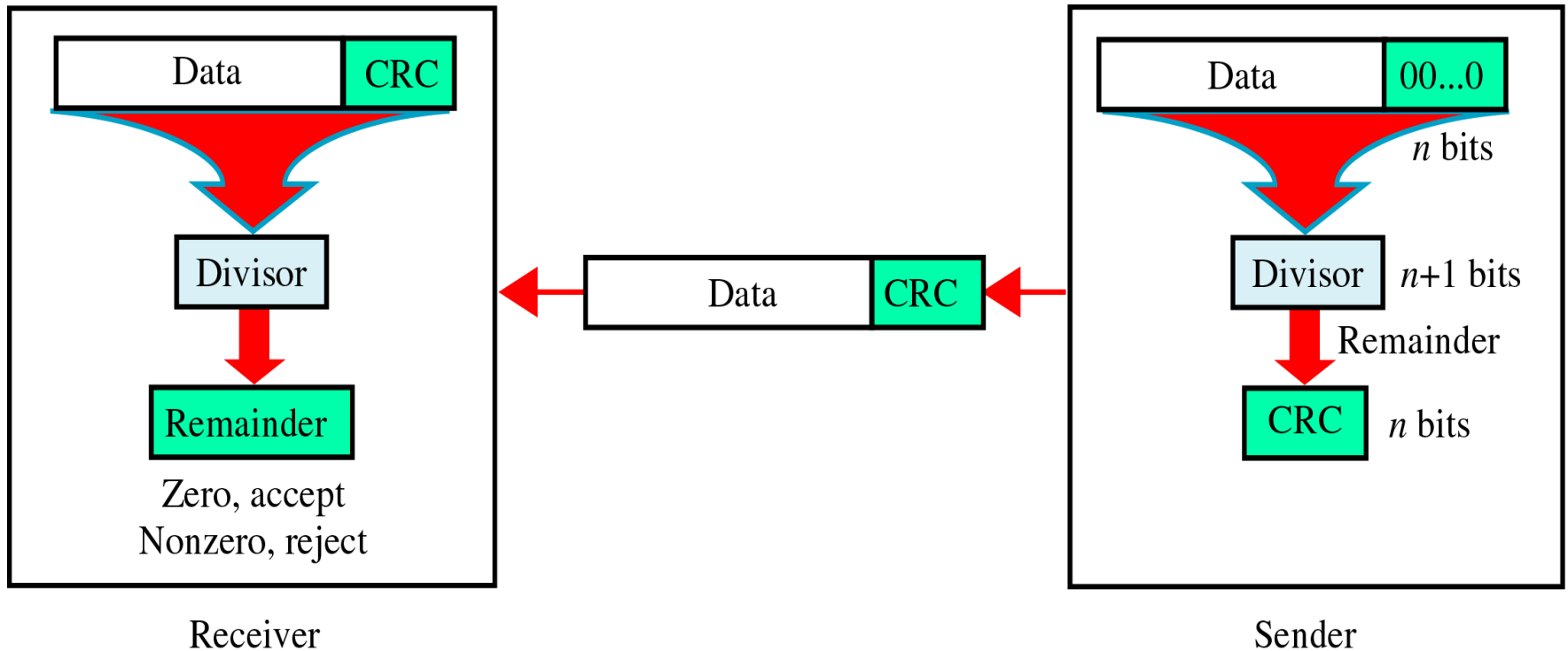
B- Two –Dimensional Parity Check

Original data

| 1100111 | 1011101 | 0111001 | 0101001 |

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

Row parities

| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | Column parities

11001111   10111011   01110010   01010011   01010101

Data and parity bits
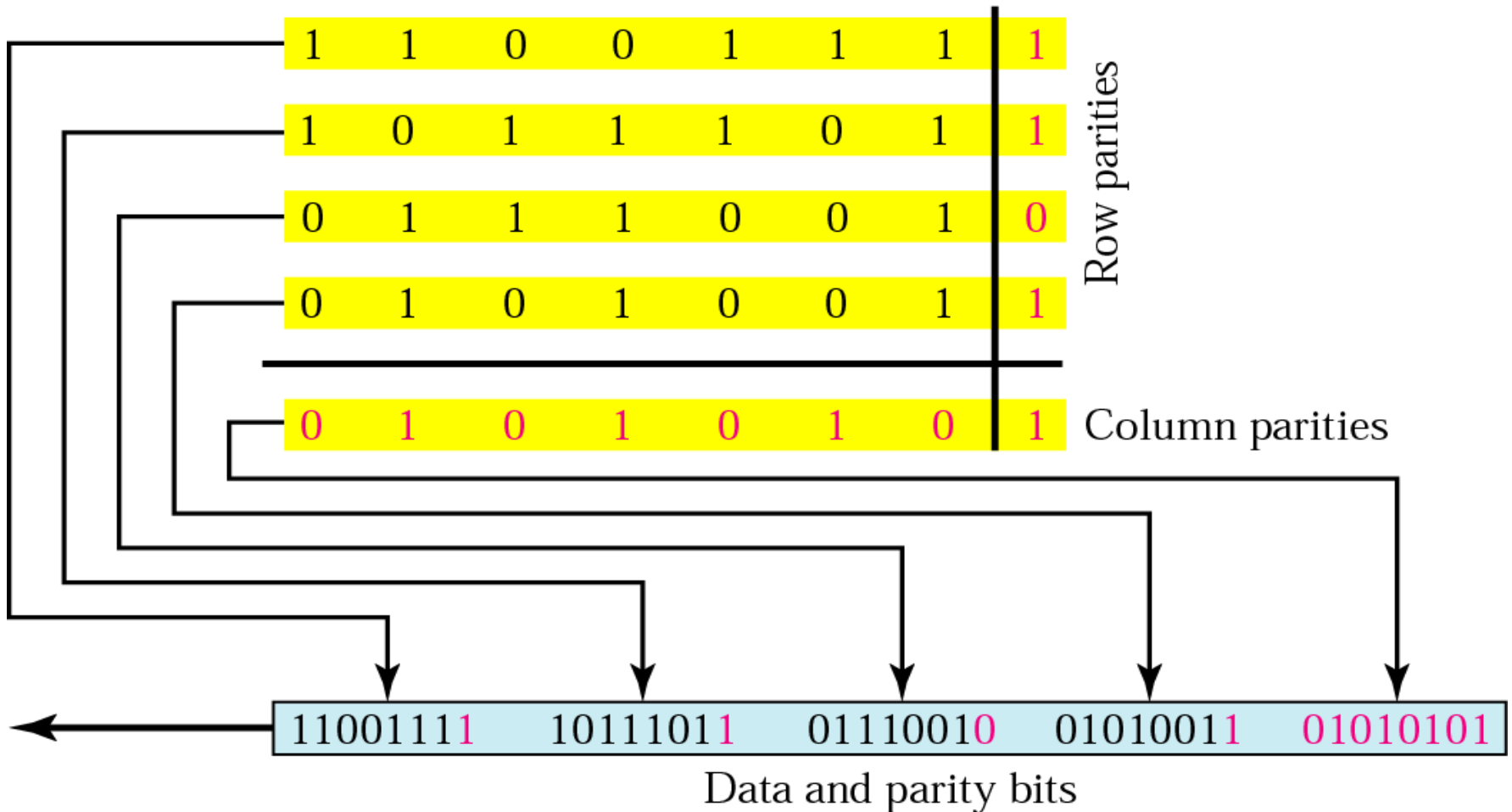
2- Cycle Redundancy Checksum (CRC) :
CRC is very effective error detection method

Receiver

Sender

3- Checksum :

Like parity check and CRC , checksum based on redundancy . The checksum used in the internet by <u>several protocol</u> not at Data link layer , but used at Network layer.

IP Ver. 4 bits	H. Length 4 bits	DS 8 bits	Total Length 16 bits	
Identification 16 bits			Flags 3 bits	Fragmentation offset 13 bit
Time To Live 8 bits		Protocol 8 bits	Header Checksum 16 bit	
Source IP Address				
Destination IP Address				

Figure is shown : IP Datagram

checksum operations :
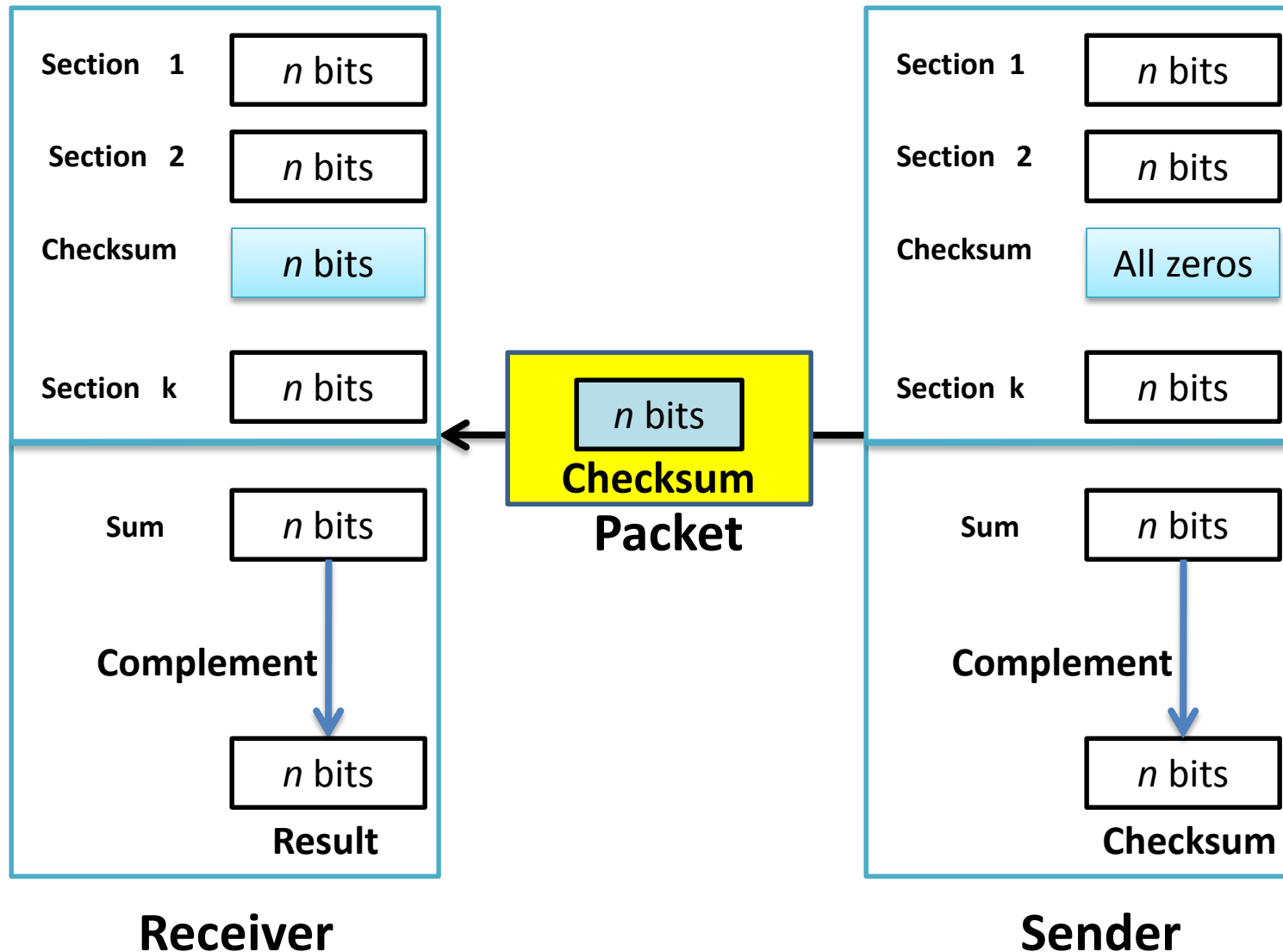
Receiver

Sender

ÖNEMLİ

Bu projeler lisansüstü öğrencilerinin hazırladığı çalışmalar olup tüm sorumluluk hazırlayan öğrencilere aittir. Öğrenciler hazırladığı projeye göre not almışlardır.