



SNS COLLEGE OF TECHNOLOGY COIMBATORE



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DEPARTMENT OF MCA

Course Name : 19CAT603 - DATA COMMUNICATION AND NETWORK

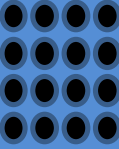
Class : I Year / I Semester

Unit II - ERROR CONTROL AND DATA LINK PROTOCOLS

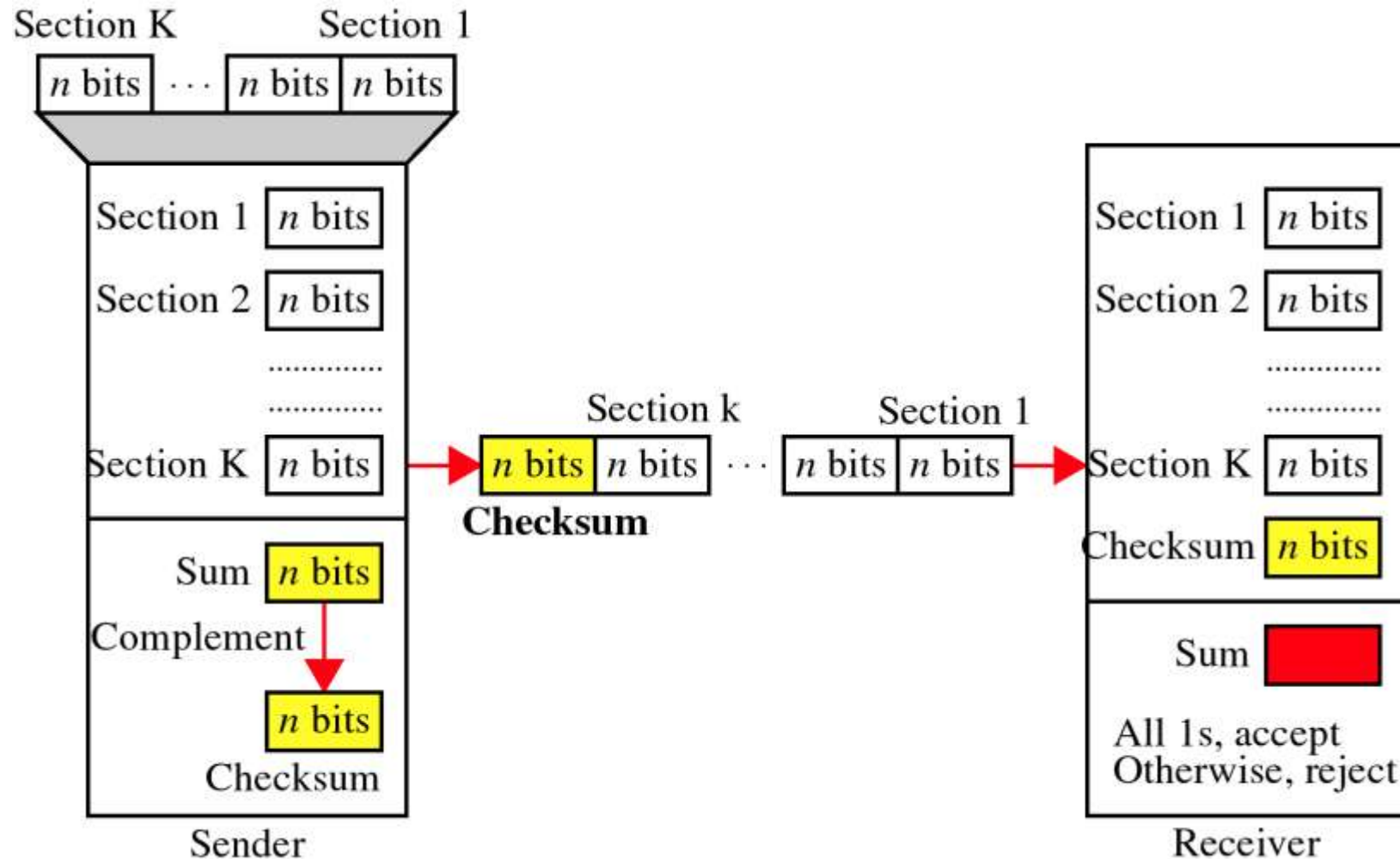
Topic 5 – CHECKSUM



Checksum

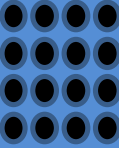


Checksum Generator





Checksum



Original Data

10011001	11100010	00100100	10000100
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1

2

3

4

k=4, m=8

Sender

```

1  10011001
2  11100010
   -----
   ①01111011
     1
   -----
   01111100
3  00100100
   -----
   10100000
4  10000100
   -----
   ①00100100
     1
   -----
Sum: 00100101
Checksum: 11011010

```

Receiver

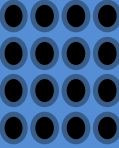
```

1  10011001
2  11100010
   -----
   ①01111011
     1
   -----
   01111100
3  00100100
   -----
   10100000
4  10000100
   -----
   ①00100100
     1
   -----
   00100101
   11011010
Sum: 11111111
Complement: 00000000
Conclusion: Accept Data

```

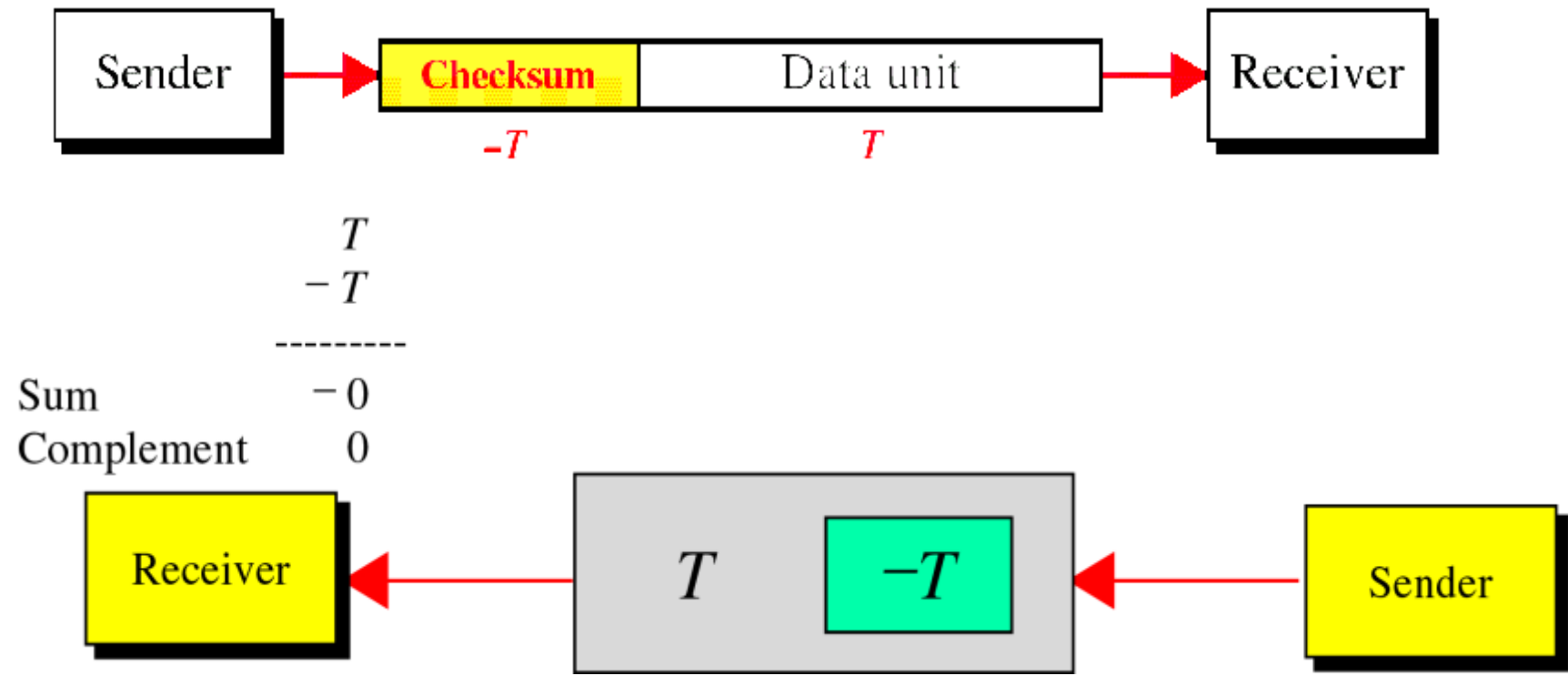


Detection



Data unit and checksum

The receiver adds the data unit and the checksum field. If the result is all 1s, the data unit is accepted; otherwise it is discarded.





At the sender



- The unit is divided into k sections, each of n bits.
- All sections are added together using one's complement to get the sum.
- The sum is complemented and becomes the checksum.
- The checksum is sent with the data



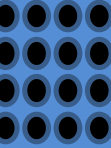
At the receiver



- The unit is divided into k sections, each of n bits.
- All sections are added together using one's complement to get the sum.
- The sum is complemented.
- If the result is zero, the data are accepted: otherwise, they are rejected.



Performance



- The checksum detects all errors involving an odd number of bits.
- It detects most errors involving an even number of bits.
- If one or more bits of a segment are damaged and the corresponding bit or bits of opposite value in a second segment are also damaged, the sums of those columns will not change and the receiver will not detect a problem.



It can be handled in two ways:

- Receiver can have the sender retransmit the entire data unit.
- The receiver can use an error-correcting code, which automatically corrects certain errors.



Single-bit error correction



To correct an error, the receiver reverses the value of the altered bit. To do so, it must know which bit is in error.

Number of redundancy bits needed

Let data bits = m

Redundancy bits = r

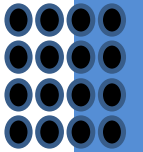
∴ Total message sent = $m+r$

The value of r must satisfy the following relation:

$$2^r \geq m+r+1$$

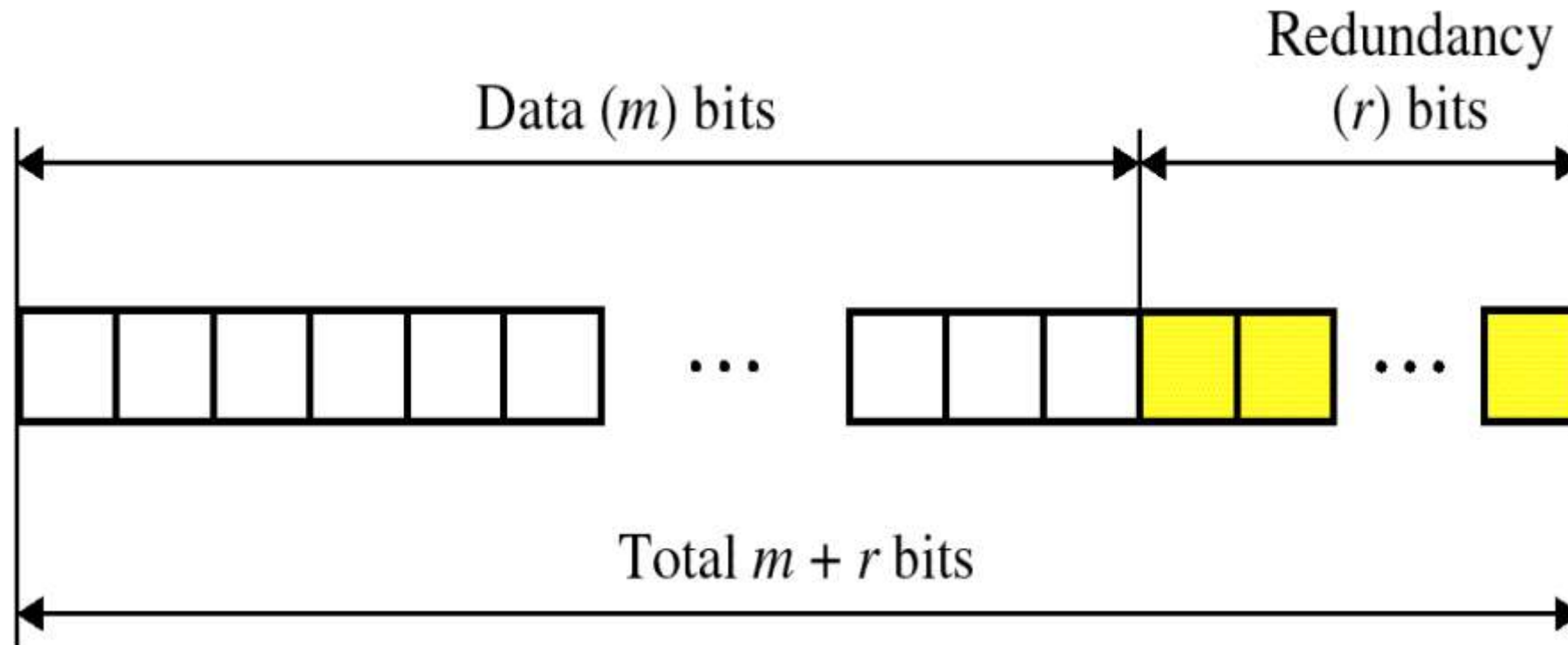


Error Correction



Redundancy Bits

~ to calculate the number of redundancy bits (R) required to correct a given number of data bit (M)





Reference



1. <https://www.geeksforgeeks.org/types-transmission-media/>
2. <https://www.javatpoint.com/guided-transmission-media>
3. <https://www.geeksforgeeks.org/performance-of-a-network/>



