Computer Network Protocols
Data Link Layer
Lesson - 3

جامعة المستقبل
كلية الهندسة والتقنيات الهندسية
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المرحلة الرابعة

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Error Detection

Error detection *means to* ***decide whether the received data is correct or not*** *without having a copy of the original message. Error detection uses the concept of* ***redundancy****, which means* ***adding extra bits for detecting errors at the destination****. There are* ***four*** *types of redundancy checks are used in data communications, these are:*

1. ***Cyclic Redundancy Check (CRC).***
2. ***Checksum.***
3. ***Vertical Redundancy Check (VRC).***
4. ***Longitudinal Redundancy Check (LRC).***

Cyclical Redundancy Check (CRC)

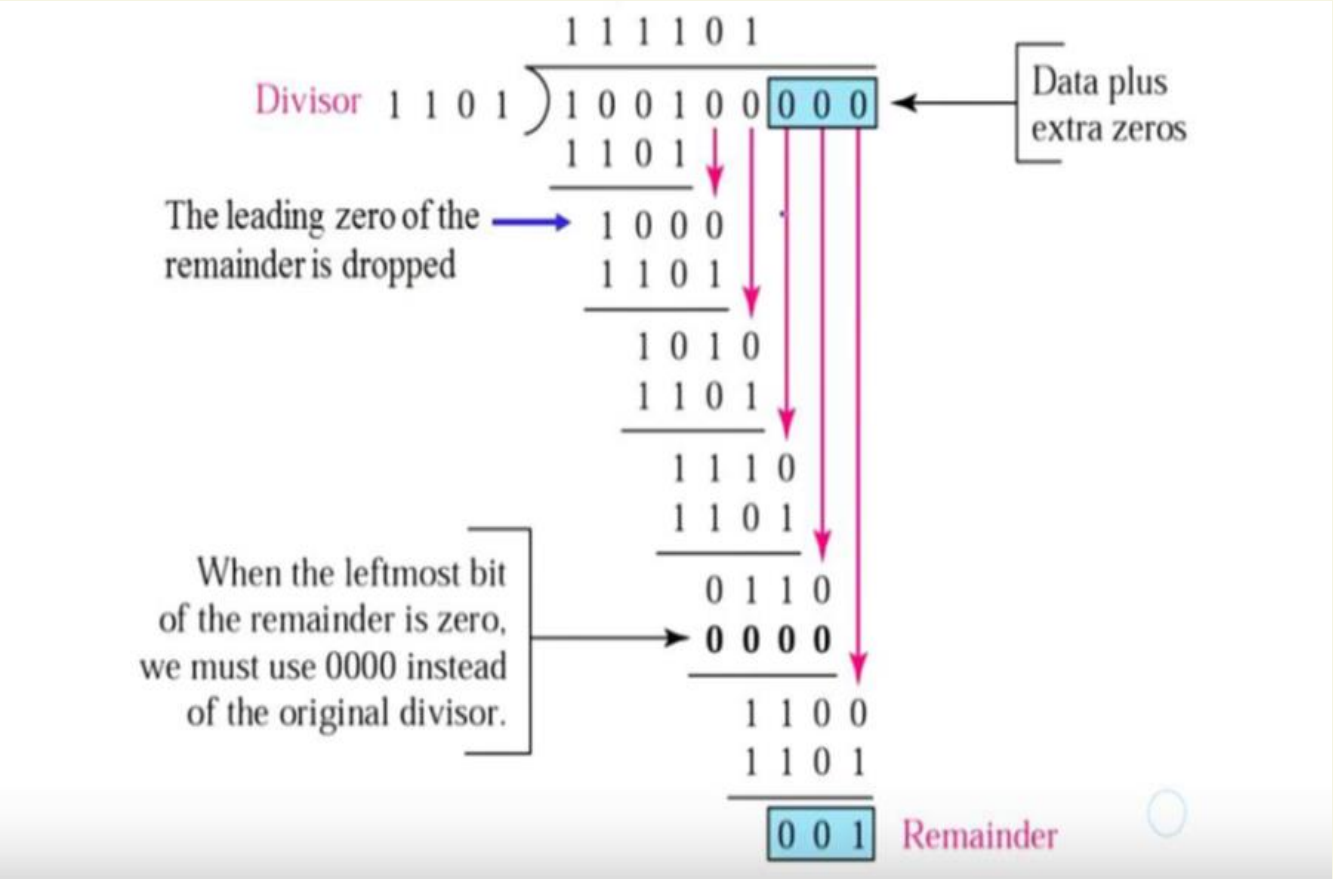
The rules are:

1. *Put “n” zeros equal to number of divisor 'bits -1 to the right side of divider.*
2. *Start long division*
3. *Use Xor*
4. *Neglect the zero to the left side of Xor operation*
5. *The reminder of long division represents the CRC code*

CRC Example

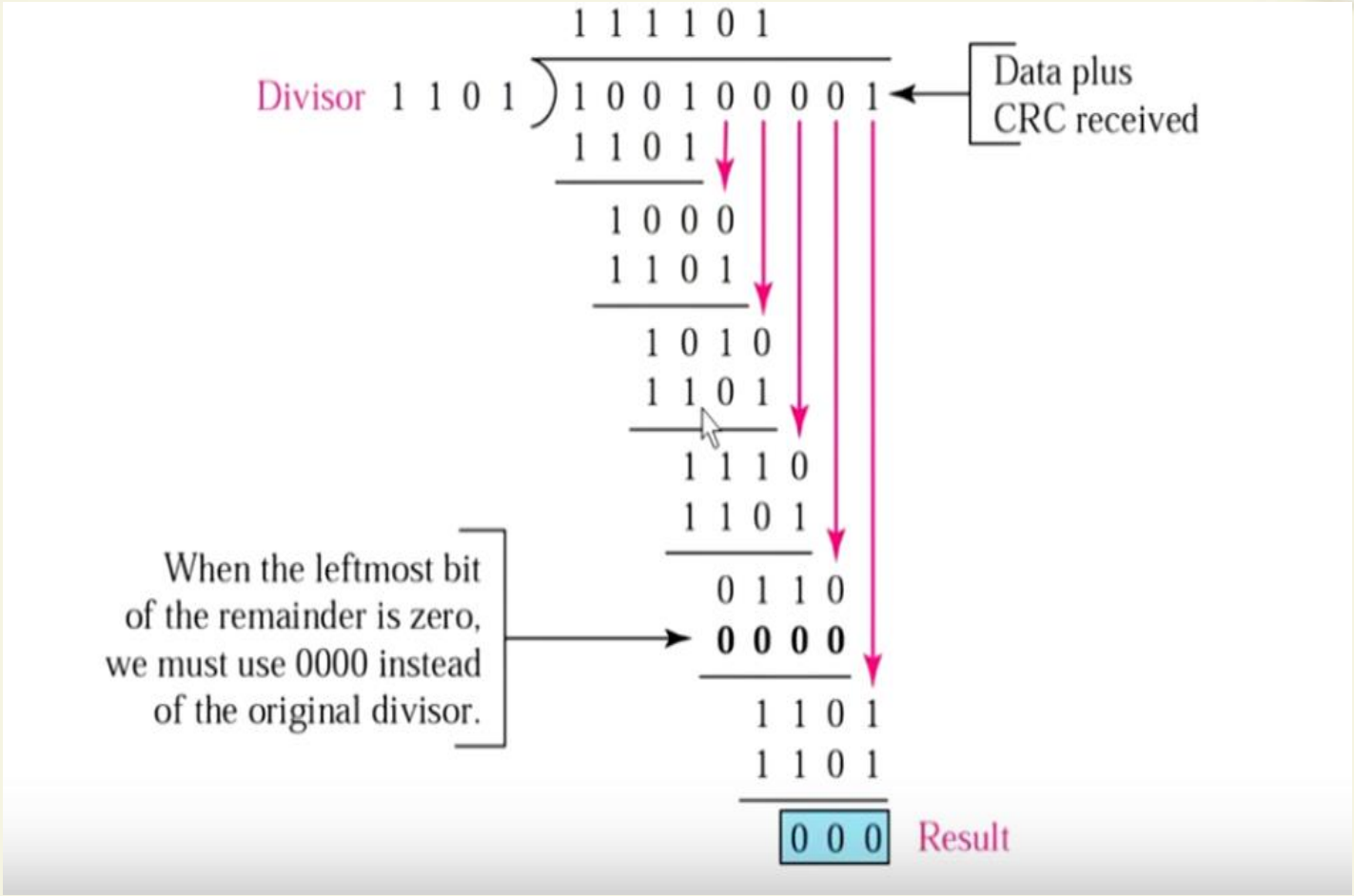
Determine the CRC code to be used to send message M(x) by using the devisor G(x) where ***G(x)= 1101*** *and* ***M(x)= 100100***

At the sender



CRC Example

At the receiver



Checksum Technique

At the Sender Side

1. *The unit is divided in to **k** sections, each of **n** bits.*
2. *All sections are **added using one's complement** to get the sum in such a way that the total is also **n** bits long.*
3. *The sum is then **complemented** and becomes the checksum.*
4. *The checksum is sent with the data.*

At the receiver Side

1. *The received data is divided in to **k** sections, each of **n** bits.*
2. *All sections are added using **one's complement** to get the sum in such a way that the total is also n bits long.*
3. *The sum is then **complemented**.*
4. ***If the result is zero, the data are accepted, otherwise they are rejected**.*

Checksum Technique Example

Suppose the following block of 16 bits is to be sent using a checksum of 8 bits.

10101001 00111001

The numbers are added using one's complement

```
                10101001
                00111001
                ----------
Sum             11100010
Checksum        00011101
```

The pattern sent is 10101001 00111001 00011101

Now suppose the receiver receives the pattern sent and there is no error.

10101001 00111001 00011101

When the receiver adds the three sections, it will get all 1s, which, after complementing, is all 0s and shows that there is no error.

```
                10101001
                00111001
                00011101
Sum             11111111
Complement      00000000   means that the pattern is OK.
```

End Of Lesson 3

Thanks For Listening