

# **Line Coding Techniques**

# Session Objectives

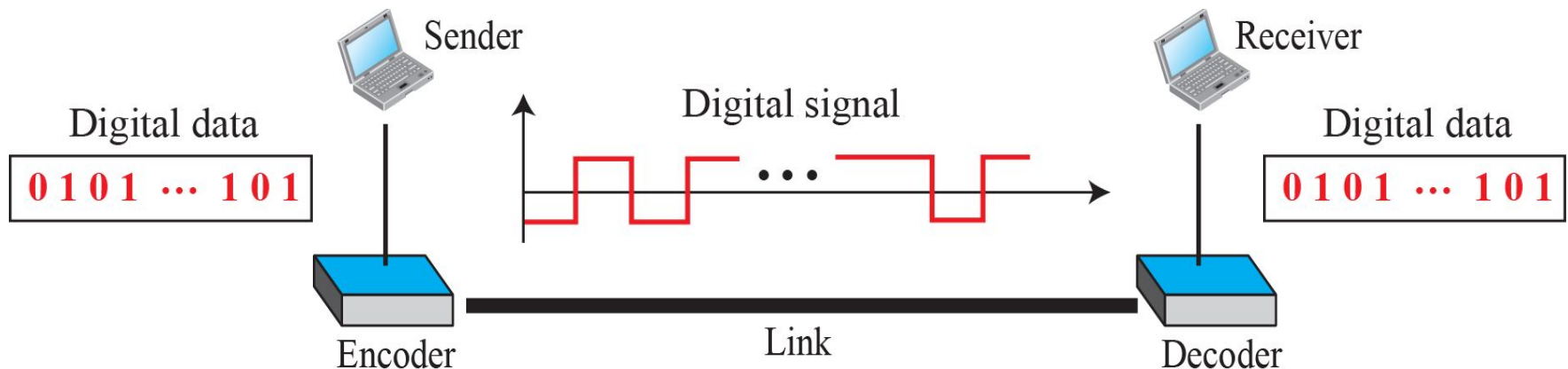
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After going through this session you will be able to understand:

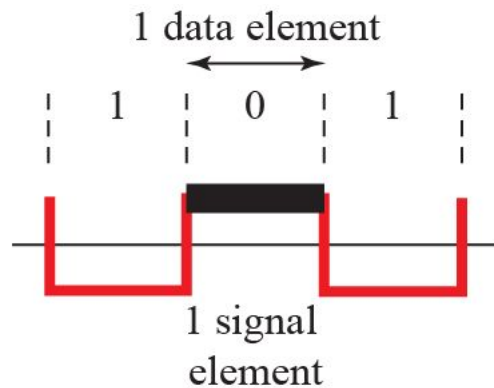
- ✓ Digital data and digital signal representation
- ✓ Technique for Line Coding

# Line Coding

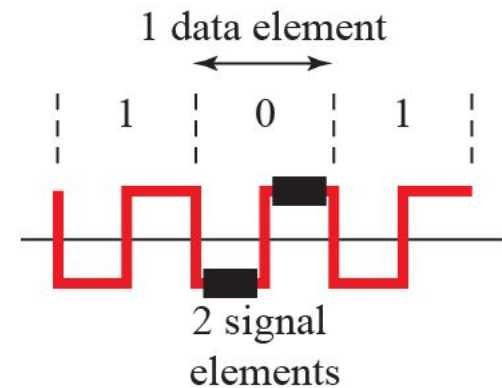
- ✓ Line coding is the process of converting digital **data** to digital **signals**.
- ✓ It is assumed that data, in the form of text, numbers, graphical images, audio, or video, are stored in computer memory as sequences of bits.
- ✓ Line coding converts a sequence of bits to a digital signal. At the sender, digital data are encoded into a digital signal; at the receiver, the digital data are recreated by decoding the digital signal.



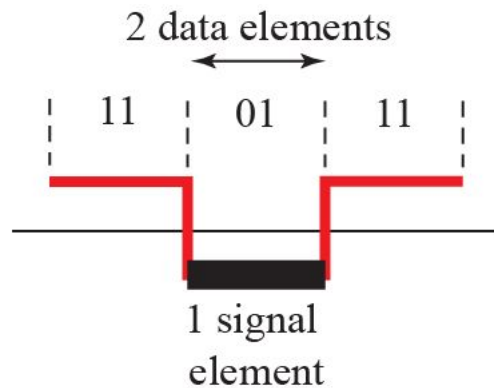
# Digital signal representation



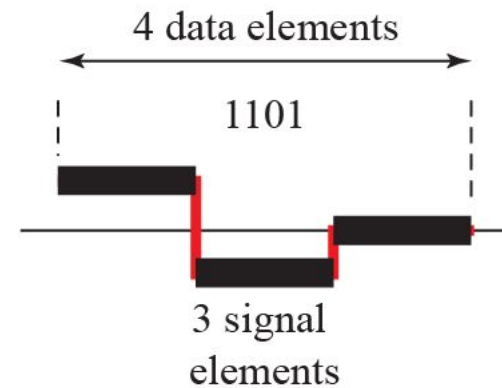
a. One data element per one signal element ( $r = 1$ )



b. One data element per two signal elements ( $r = \frac{1}{2}$ )



c. Two data elements per one signal element ( $r = 2$ )



d. Four data elements per three signal elements ( $r = \frac{4}{3}$ )

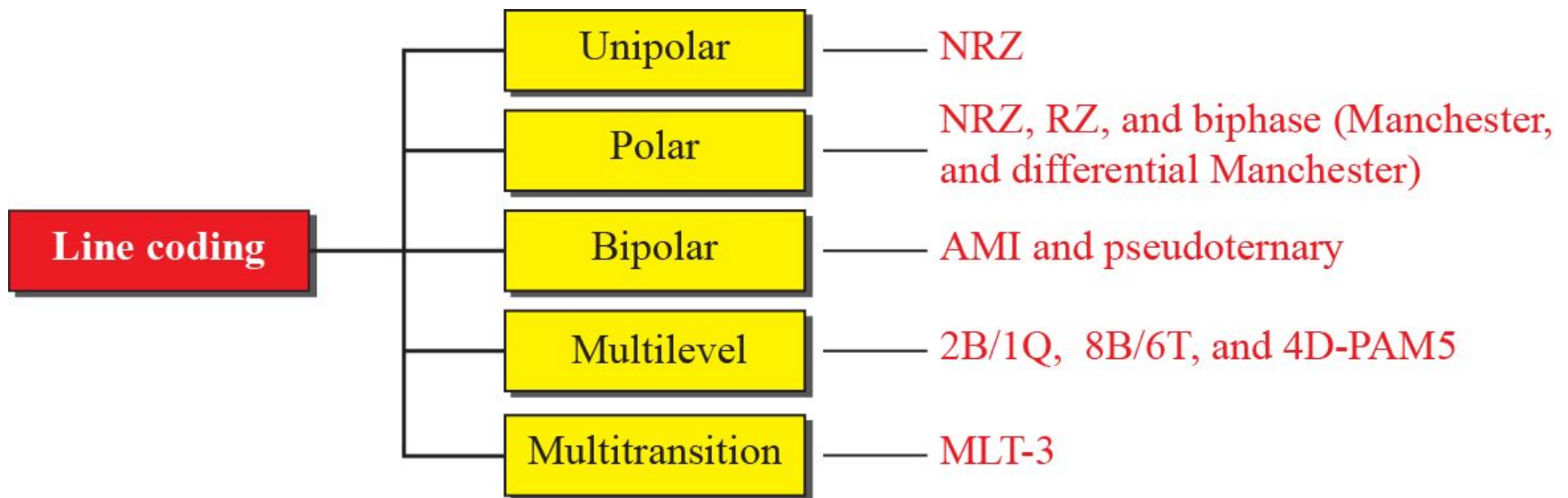
# Line Coding Schemes

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## Polarity

The separation, alignment or orientation of something into two opposed poles.

*We can roughly divide line coding schemes into five broad categories, as shown below*



**NRZ: Non return to zero**

**NRZ-I: non return to zero inverted**

**AMI: Alternate Mark Inversion**

**2B1Q: Two-binary, one-quaternary**

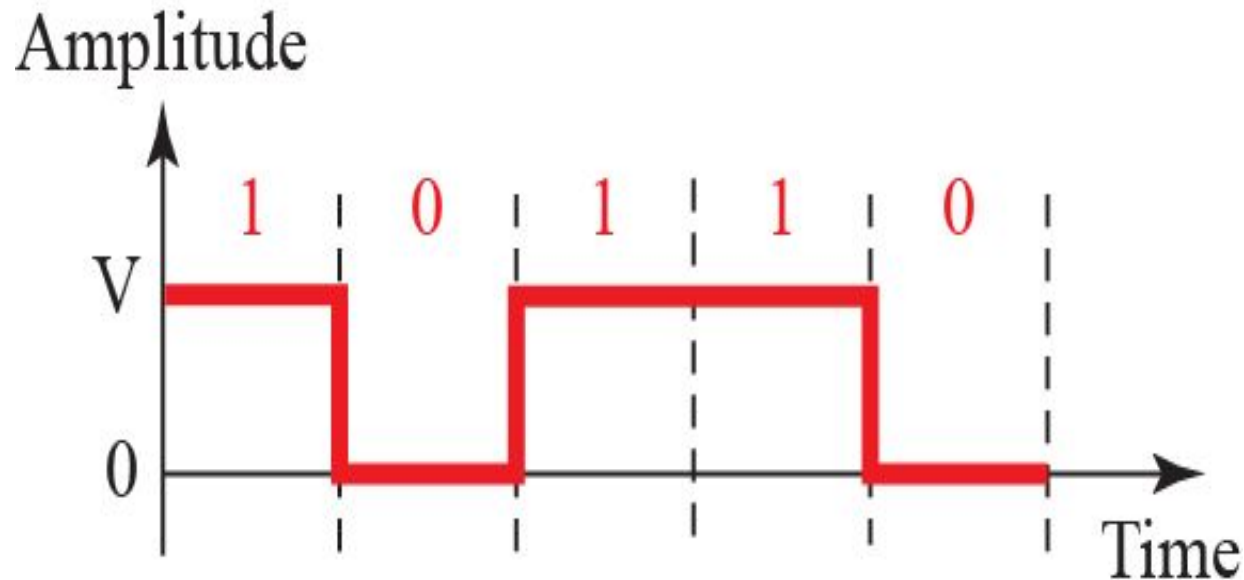
**4D-PAM5: 4-data line, 5-level pulse amplitude modulation**

**MLT-3: Multi-Level Transmit**

# Unipolar NRZ Coding

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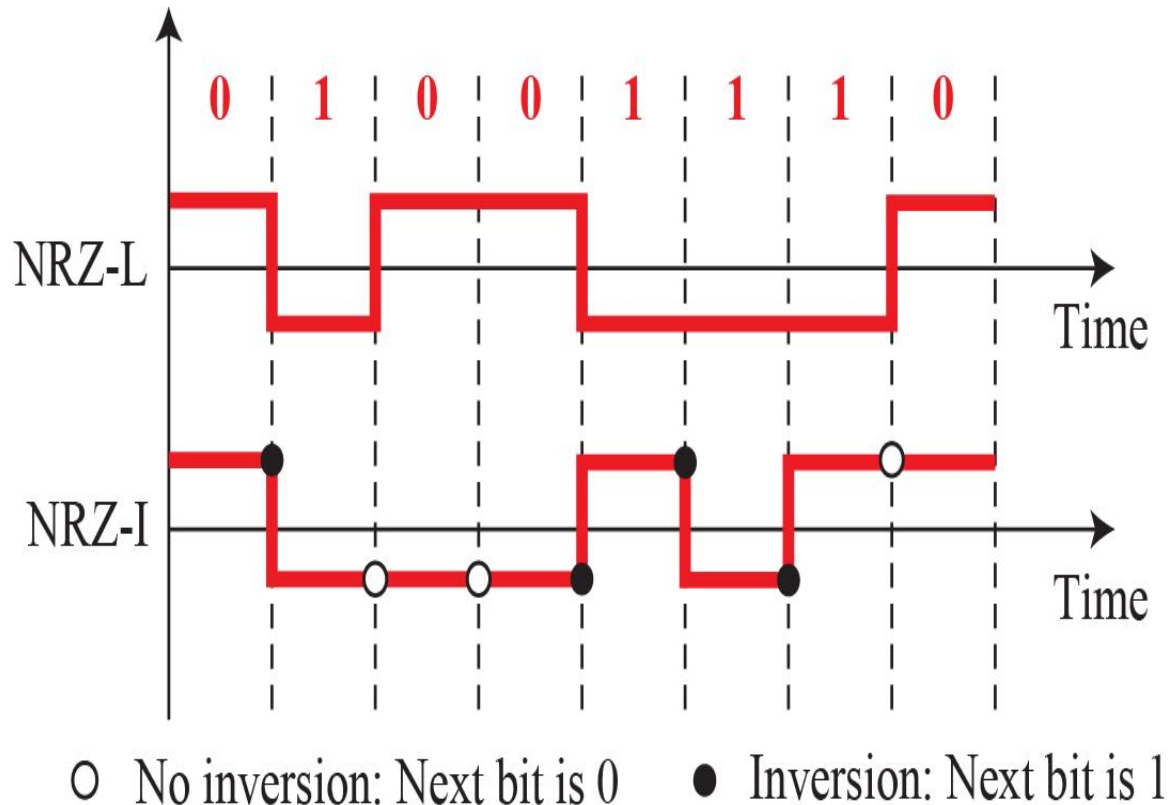
**Unipolar** encoding only makes use of one polarity, i.e. positive voltage, to represent a binary 1 and it uses an idle line to represent a binary 0, i.e. zero voltage.



# Polar NRZ-L and NRZ-I Coding

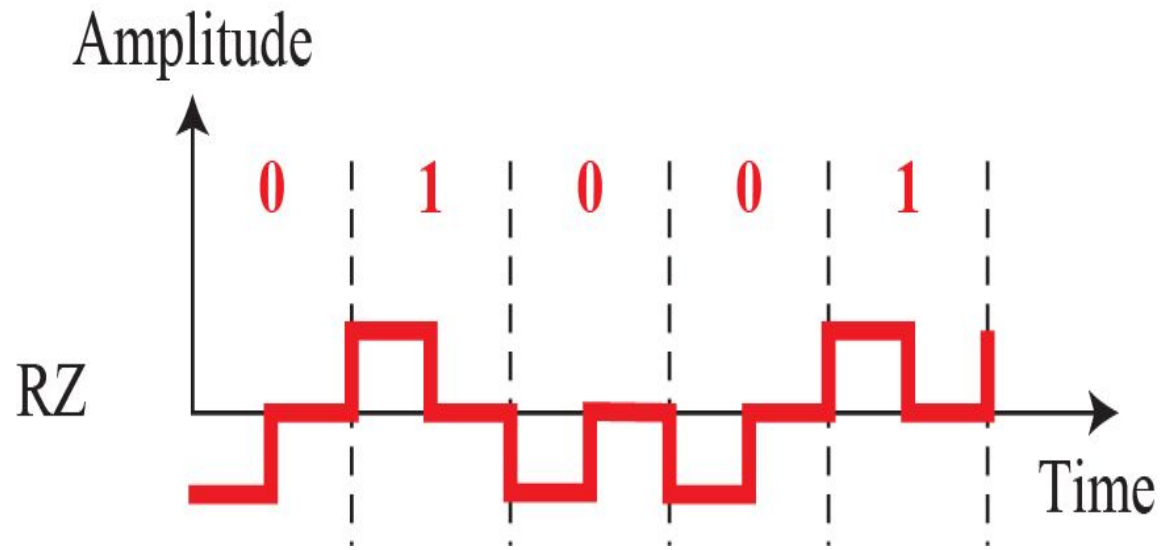
## Polar schemes

In polar schemes, the voltages are on the both sides of the axis. Examples NRZ-L, NRZ-I



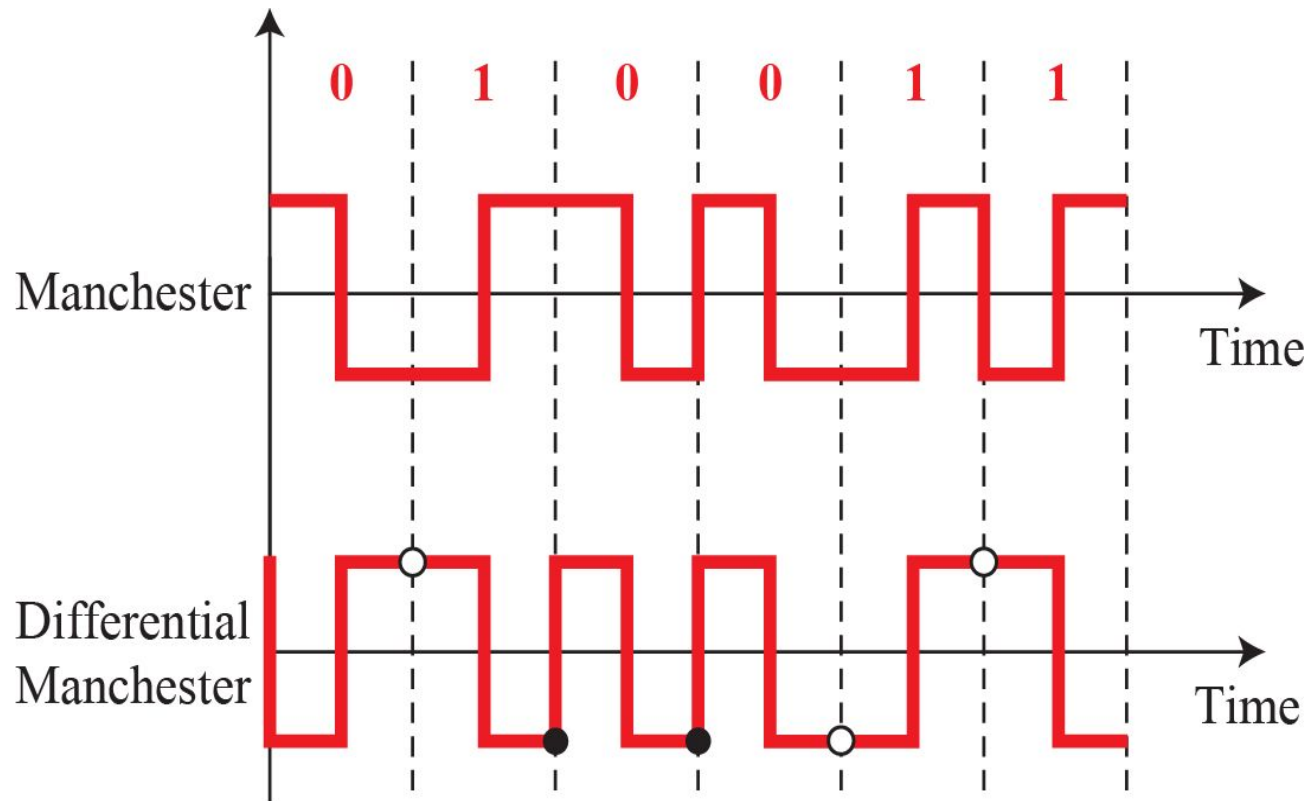
# Polar RZ Coding

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# Polar Manchester and Differential Manchester Coding

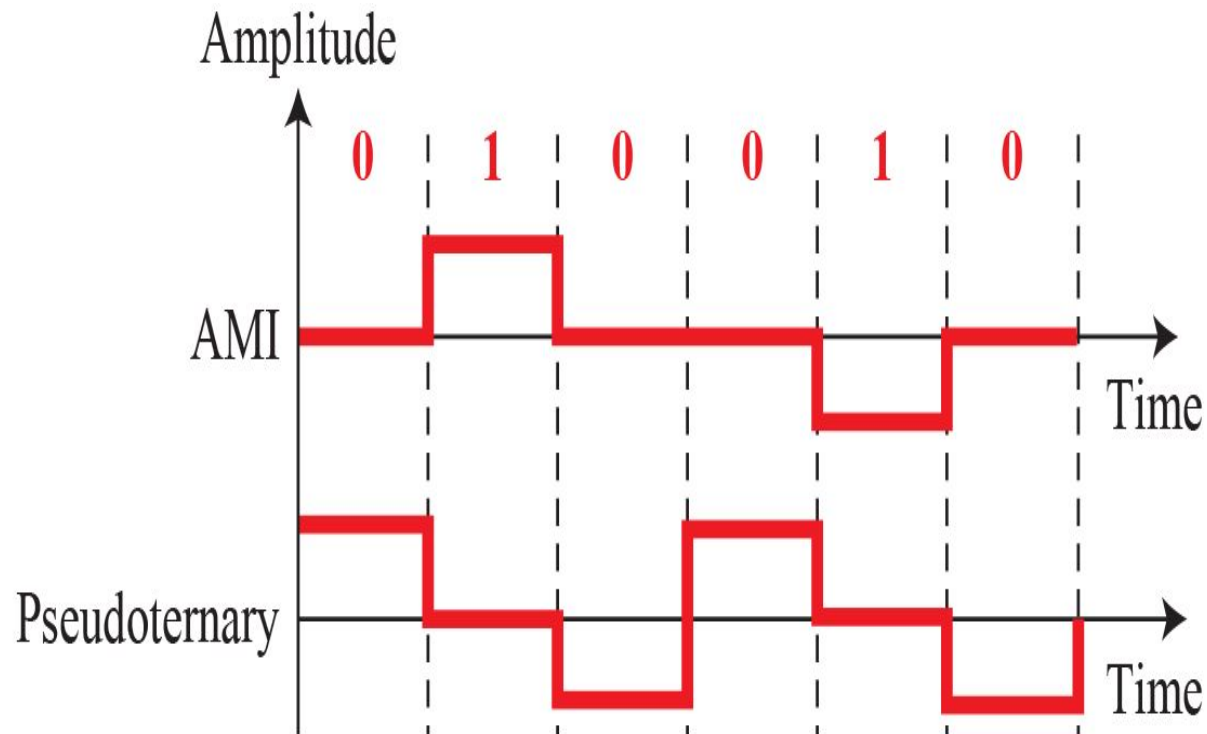


○ No inversion: Next bit is 1    ● Inversion: Next bit is 0

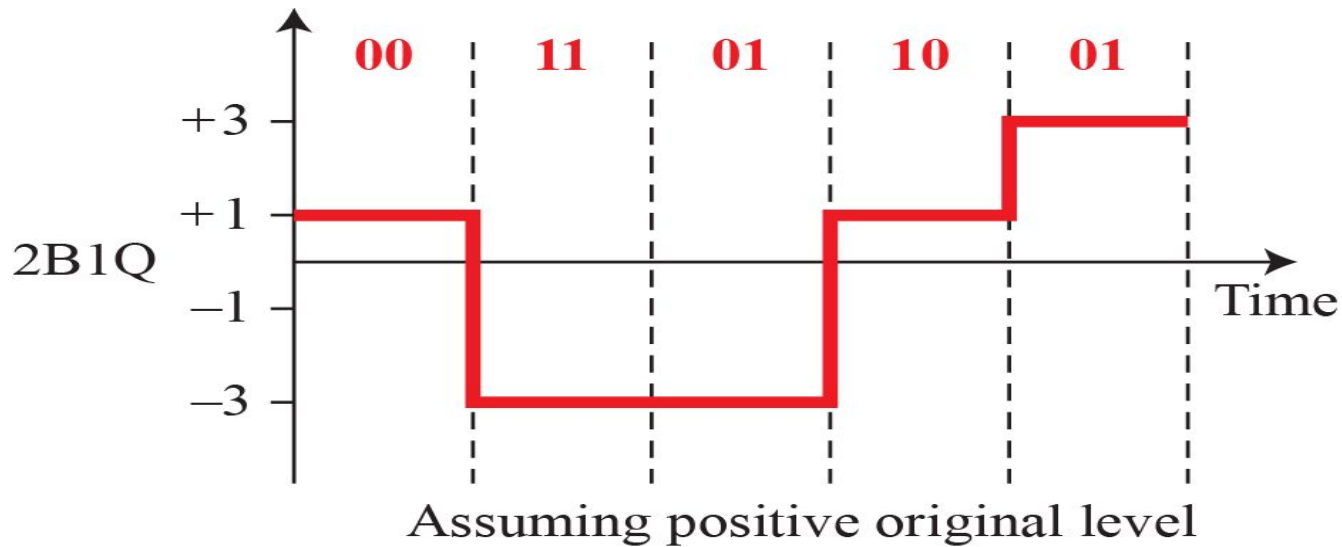
# Bi-Polar AMI and Pseudoternary Coding

## Bipolar schemes

In this scheme there are three voltage levels positive, negative, and zero. The voltage level for one data element is at zero, while the voltage level for the other element alternates between positive and negative.



# Multilevel 2B1Q



	previous Level: Positive	Previous Level: Negative
Next Bit	Next Level	Next Level
00	+1	-1
01	+3	-3
10	-1	+1
11	-3	+3

# Activity

For the give data pattern

a) 1011001011000111

b) 1111000010110101

Apply the following Algorithms

1. NRZ, NRZ-I, NRZ – L
2. RZ
3. Manchester and Differential Manchester
4. AMI
5. Pseudoternary
6. 2B1Q

# ***Summary***

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In this section we have discussed the following:

- ✓ Line Coding Techniques
- ✓ Polar and bi-polar technique for coding

Thank  
you!