AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH
Faculty of Engineering

Course/Lab Name:	Data Communication		
Semester: Spring 2023-24	**Term**: Mid	**Assignment-1**	

Question Mapping with Course Outcomes:

Item	COs	POIs	K	P	A	Marks	Obtained Marks
All Problems	**CO3**	**P.c.3.C5**	**K5**	**.**	**.**	**30**	
					Total:	**30**	

Student Information:

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Section: H	**Department:** CSE

Instructions for submission:

1. Use this page as a cover page.

2. Take pictures of your written answer and paste under each problem given below.

3. Give the file name using the middle 5 digits of your student ID.

For instance: if your ID is 20-40708-3 your file name will be 40708.pdf

4. Upload the pdf file to MS Teams portal.

5. The submission will not be considered if the instructions are not followed.

Answer the following Questions:

Problem 01: Why baseline wandering, DC component and lack of synchronization is a problem in digital data to digital signal representation, explain with necessary figures.

Answer:

Answer to the question no-01

Baseline Wandering: In a digital signal, the receiver calculates a running average of the received signal power, this average is called the baseline. A long string of 0's or 1s can cause a drift in the baseline and make it difficult for the receiver to decode correctly.

Problem: Baseline wandering can lead to difficulties in accurately detecting the actual signal levels, as it may cause confusion between signal variations and the slow drift in the baseline.

A good line coding needs to skip baseline wandering.

DC component: In a digital signal when the voltage level is constant, spectrum creates a low frequency near by zero is called DC component.

Problem: The presence of a DC component can lead to issues such as difficulties in clock recovery and potential distortion of the signal during transmission.

Lack of Synchronization: For the receiver end to successfully recover the signal, synchronization is important. A lack of synchronization indicates that the time of the transmitter and receiver are not exactly in line.

Problem: Without proper synchronization, the receiver may sample the signal at the wrong instants, leading to misunderstand data and potential errors.
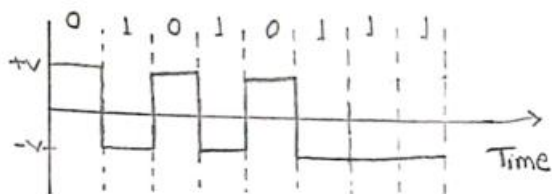
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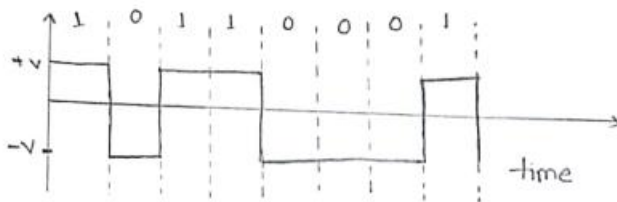
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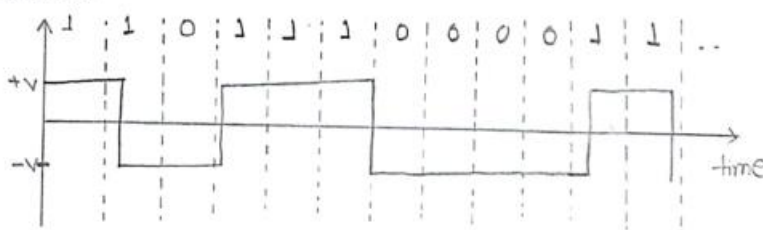
Problem 02: Draw the graph of the NRZ-L for the bit stream 01010111, assuming that the last signal level has been positive.

Answer:
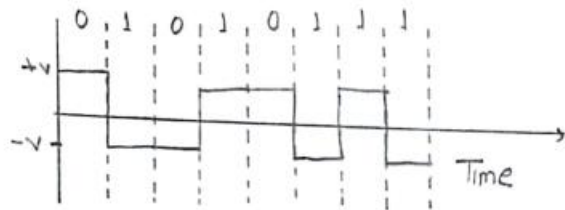
Answer to the question no-02

NRZ-L: 01010111

Problem 03: Repeat problem 02 for NRZ-I.
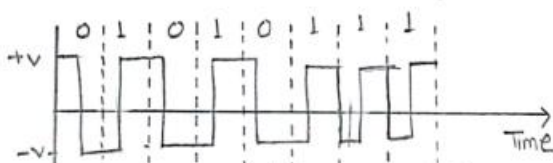**Answer:**

Answer to the question no-03

NRZ-I: 01010111

Problem 04: Repeat problem 02 for Manchester and Differential Manchester.
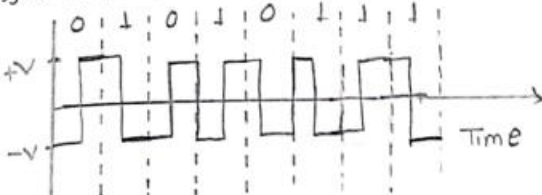**Answer:**

Answer to the question no-4

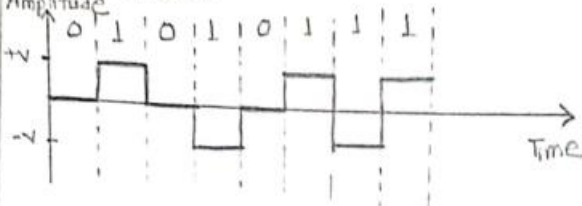Manchaster: 01010111

Diffenential Manchaster: 01010111

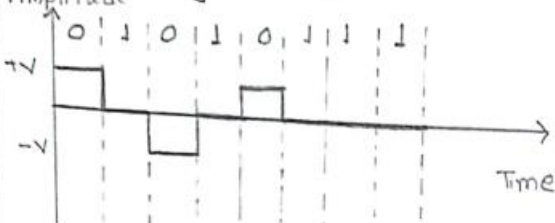**Problem 05**: Encode digital bit stream 01001101 using AMI and Pseudoternary.
Answer:

Answer to the question no-05

AMI: 01010111

Pseudoternany: 01010111

Problem 06: Encode digital bit stream 0011001100110011 by using 2B1Q by assuming last signal level was positive and consider the voltage level for each bit stream pair according to following table:

Bit stream pair	Previous level positive Next level	Previous level negative Next level
00	+2	-2
01	+4	-4
10	-2	2
11	-4	4

Answer:

Answer to the question no-06

2B1Q : 0011001100110011
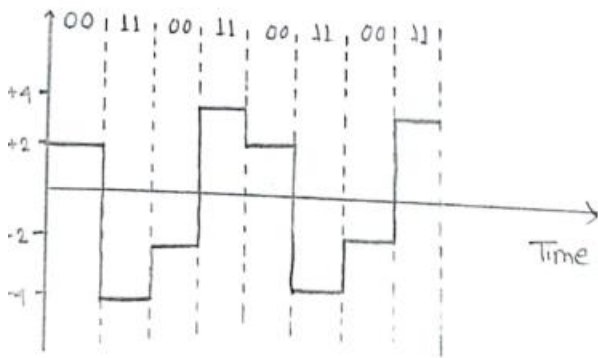
Problem 08: Determine the combination of data element and signal element in 8B6T line coding method. Write the possible use cases of remaining signal element in 8B6T.

Answer:

Answer to the question no-8

8B6T :

$2^8 = 256$ different data patterns and $3^6 = 729$ different signal patterns.

There are $729 - 256 = 473$ redundant signal elements that provide synchronization, error detection and correctly.

Problem 09: Sketch the line coding sequence using 8B6T for following data and signal pattern:

Data pattern in Hexa Decimal/binary	Signal pattern
2A (00101010)	+ 0 + - 0 -
6D (01101101)	++0+--
6C (01101100)	0++--+

Answer:

2A (00101010) = + 0 + − 0 −
6D (01101101) = + + 0 + − −
6C (01101100) = 0 + + − − +

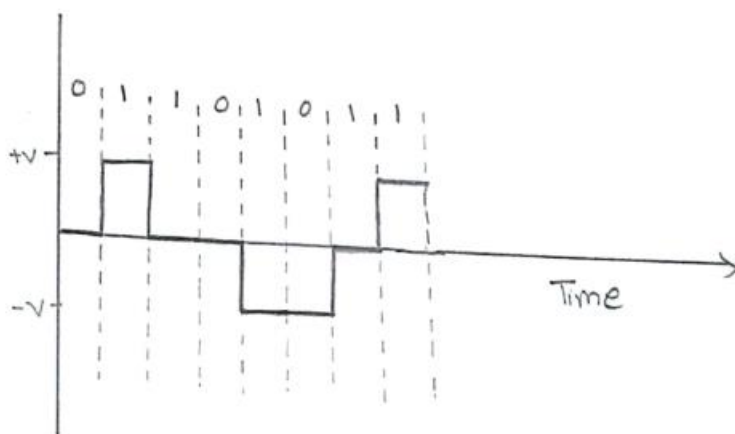invert 0 − − + + −

+ 0 + − 0 −   + + 0 + − −

0 + + − − +
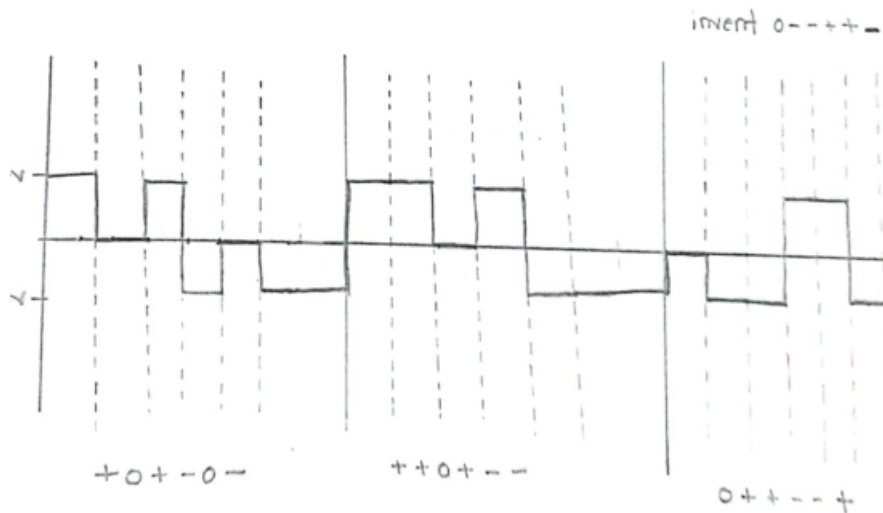
Problem 10: Encode digital bit steam 01101011 by using MLT-3 (**Note:** Assume last level was at 0 voltage and last non-zero pulse was negative).
Answer:

MLT-3 :

Next bit	Current level	Transmission
0		No change
1	Not 0	0
1	0	opposite of last non-zero level

The end