BRAC
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Assignment 05

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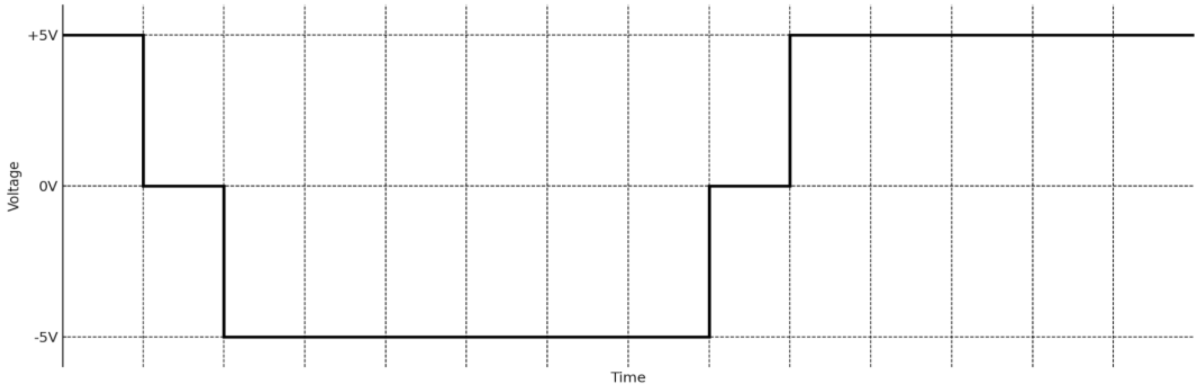
Section: 03

Course code: CSE320

Course title: Data Communication

Semester: Spring 25

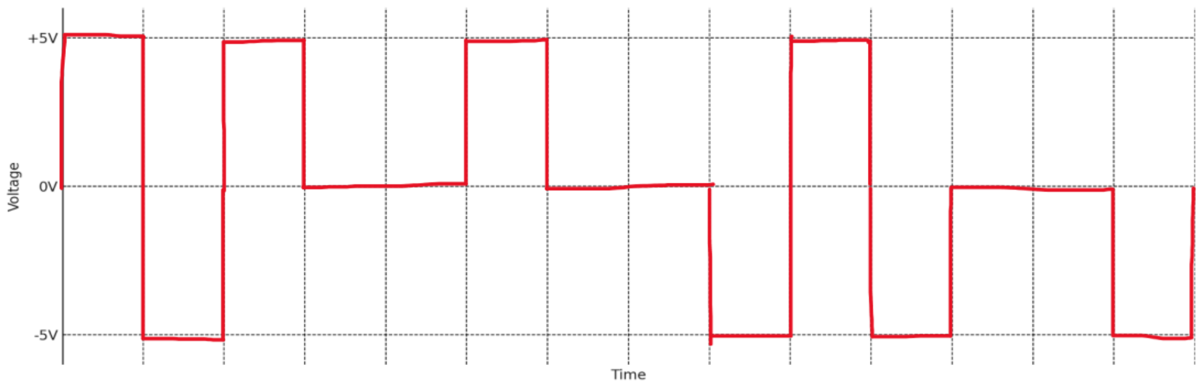
Answer to the Question No. 01



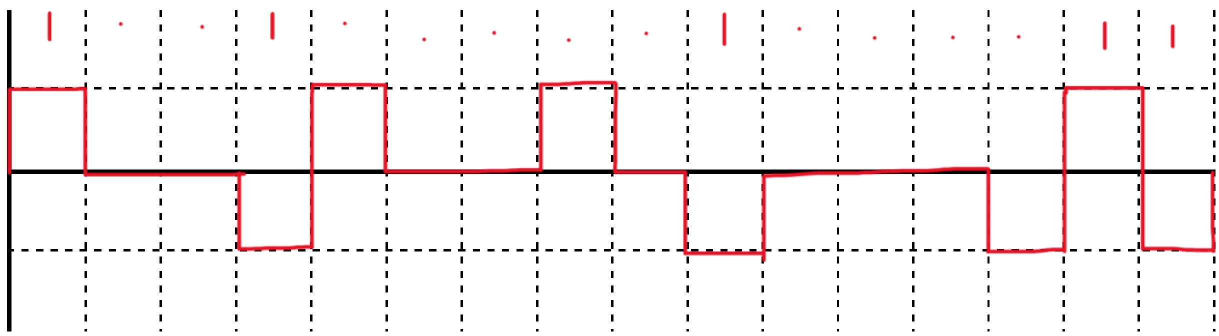
A. 11000000110000

B. As there is a long sequence of 0 in the data the signal suffers from baseline wondering and DC components issue.

C. Suitable technique such that the signal do not suffer for 4 consecutive zero is HDB3



D. Data: 1001000001000011
Using HDB3



<u>**Answer to the Question No. 02**</u>

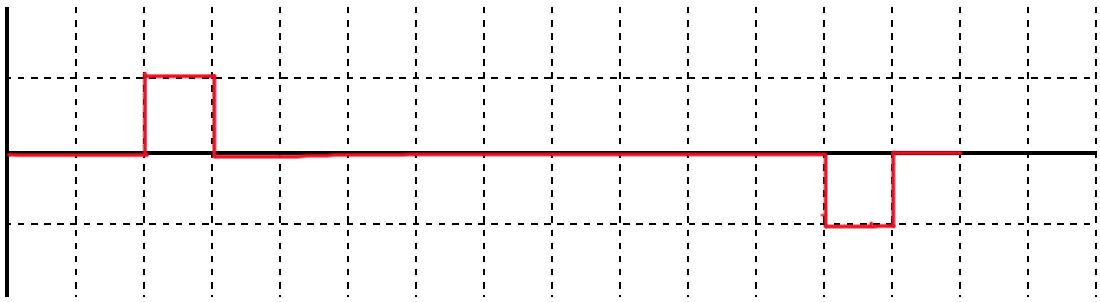
A.

Baseline Wondering: A long string of 0's or 1's can cause a drift in the baseline which called baseline wondering. It can make it difficult for receiver to decode correctly.

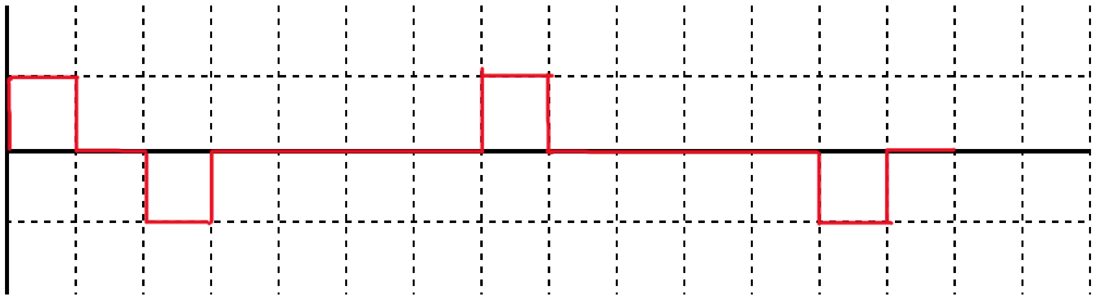
DC Components: When the voltage level in a digital signal is constant for a while, the spectrum creates very low frequencies, these frequencies around zero are called DC components.

B.

i. 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0



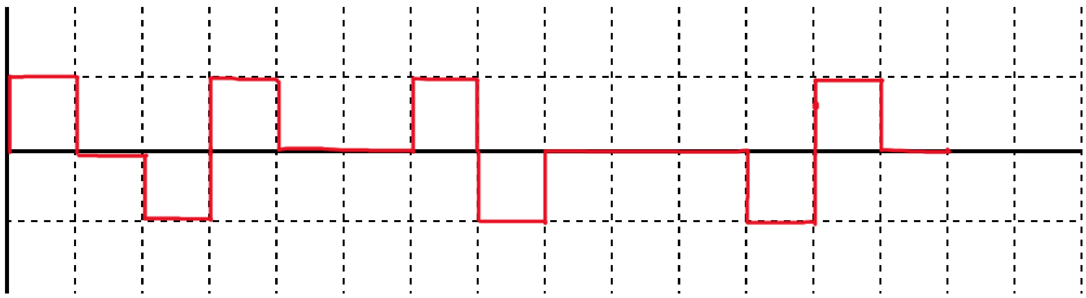
ii. 1 0 1 0 0 0 0 1 0 0 0 0 1 0



C.

Yes, it contains the Baseline Wondering problem.

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



HBD3 is used to solve this problem.

<u>**Answer to the Question No. 03**</u>

<u>A.</u>

(i) Redundant bit per block = (4-3) = 1

Percentage of Redundant bit = (Redundant bit / Total bit) * 100% = (1/4)*100% = 25%

(ii) 0100 1010 1111 0101

Original:

0100 → Not in the table

1010 → 111

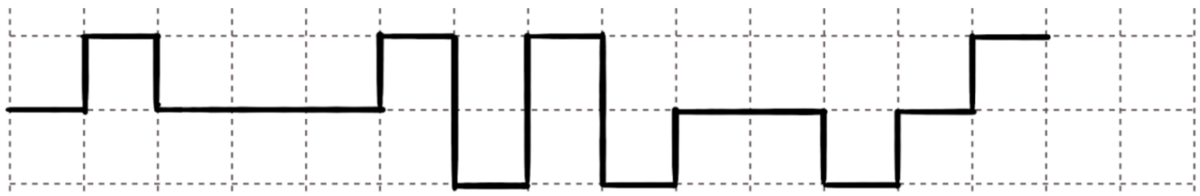
1111 → 101

0101 → 010

As 0100 is not present in the table for 1010 1111 0101 the original bit stream is 111 101 010

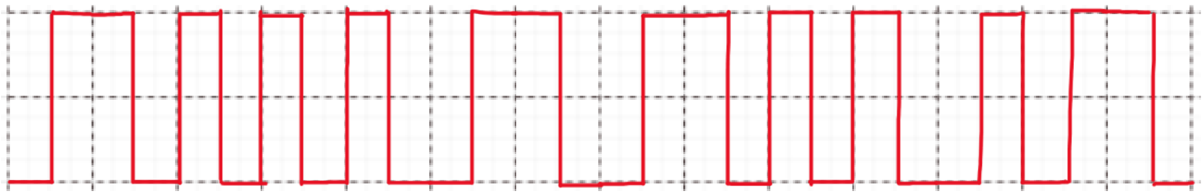
(iii) From the table we can see there will be maximum 2 0's.

B.



Bit sequence is: 01000111100101

Differential Manchester



<u>**Answer to the Question No. 04**</u>

A. 101 000 110 100 001

101 → 01011

000 → 10110

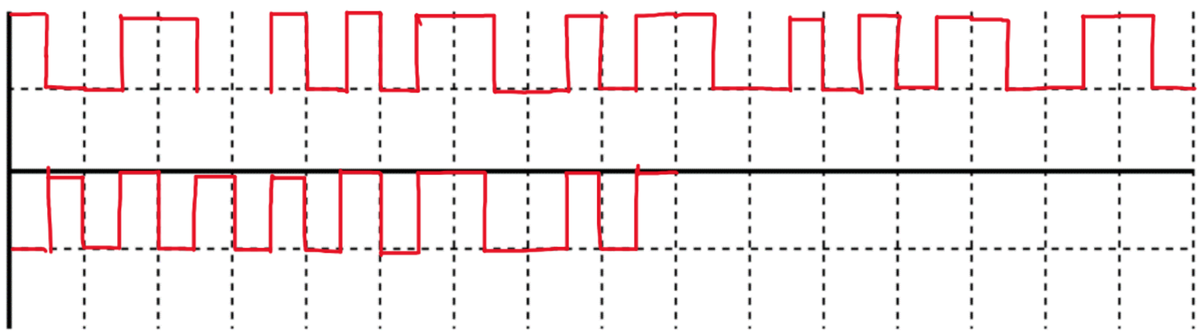
110 → 11101

100 → 01111

001 → 11011

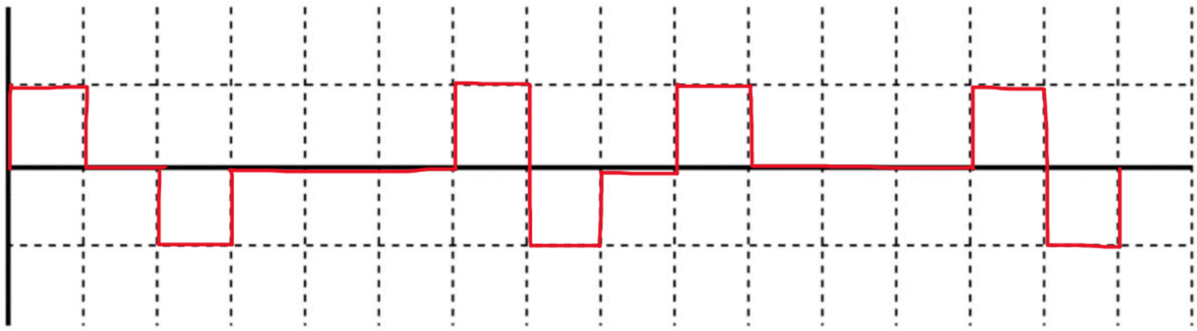
Encoded bit stream is: 01011 10110 11101 01111 11011

B. The appropriate line code scheme is Manchester



C. Manchester scheme is comparatively complex. To resolve long sequence of 0's issue in given bit stream in A HBD3 can be used.

Given, 101 000 110 100 001



Answer to the Question No. 05

<u>A.</u> Data: 1 1 0 1 0 0 0 0 0 0 0 1 0 0 0

Using Bipolar AMI

Technique to prevent long sequence of 0, using HBD3

Data: 1 1 0 1 0 0 0 0 0 0 0 1 0 0 0

B. The characteristics of Bipolar AMI

1. Three volage level
2. Alternate pulsing
3. No DC components
4. No self-synchronization for 0

It addresses and solve the long strings of 1's problem by alternating between positive and negative for 1.

D. In bipolar scheme 3 levels are used. These are: 1. Positive Voltage, 2. Zero Voltage, and 3. Negative Voltage.

Answer to the Question No. 06

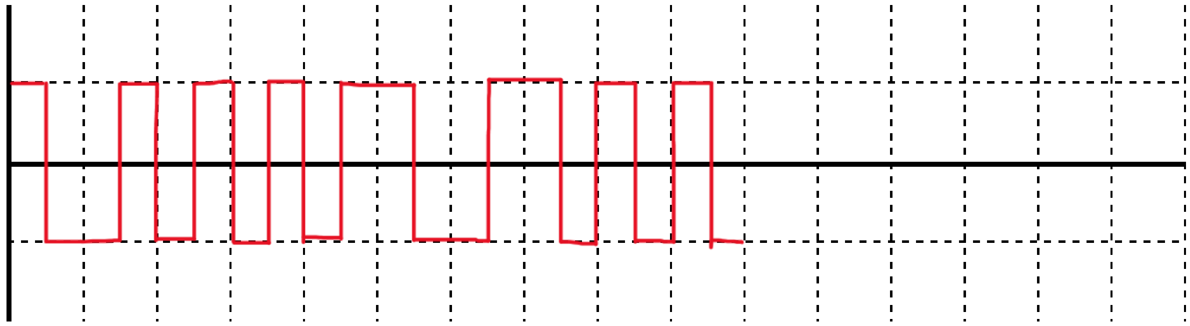
B.

Manchester and Differential Manchester encoding schemes solve the problem of consecutive 0's and 1's by ensuring frequent transitions in the signal. These frequent transitions result in a higher bandwidth requirement which is twice than the NRZ because the signal changes state more often, introducing higher frequency components.

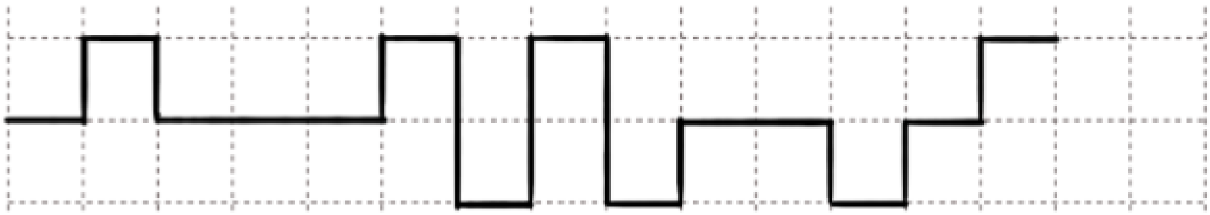
C.

i. After decoding we get: 0111101000

ii. Using Manchester, cause there's no synchronizing problem in it.

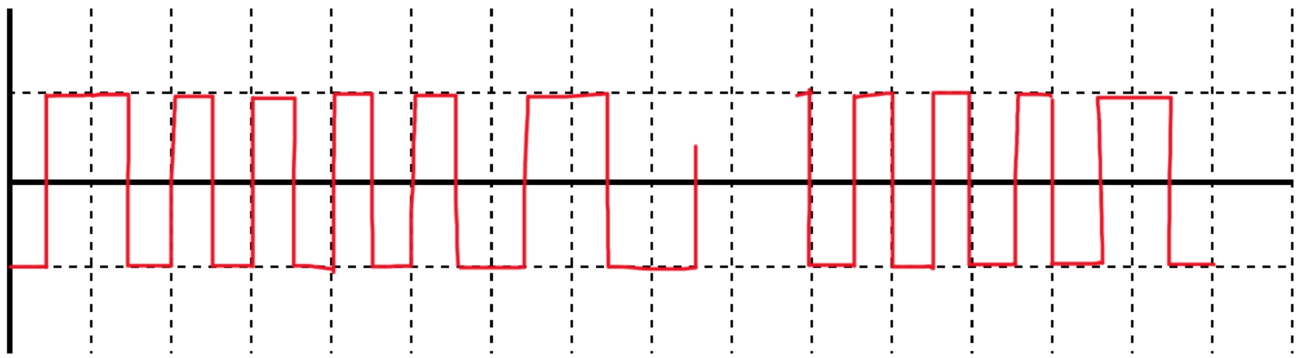


Answer to the Question No. 07



A. Decoding: 010000111000001

B. Using Differential Manchester



Answer to the Question No. 08

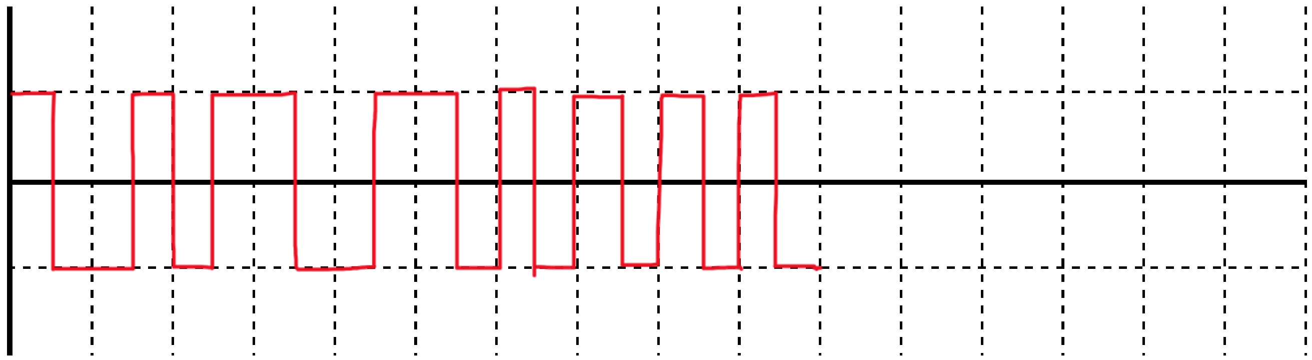
A. The synchronization problem occurs when the receiver loses track of the bit boundaries in a digital signal. This happens when the signal does not have enough transitions in the cases of long sequences of 0's or 1's. It makes difficulties for the receiver to determine where one bit ends and the next begins. NRZ-L can handle this issue neither for 0 nor 1. NRZ-I can handle for 1, however it fails for 0. But Manchester of Differential Manchester can handle for both by transition. It touches the Zero Voltage for both 0 and 1. That's why the receiver can differentiate data and sync with the sender.

B. Baseline wandering is worse in NRZ-L because the signal can drift in both directions during long sequences of 0's or 1's, but in NRZ-I, the signal only drifts in one direction during long sequences of 0's.

C.

i. 0 1 1 0 1 0 0 0 0 0

ii. Using Manchester



Answer to the Question No. 09

A

Unipolar	Polar	Bipolar	Multitransition
1. Two levels. 0 and +ve.	1. Two levels. 0 and +ve.	1. Three levels. 0, +ve, and -ve.	1. Multiple levels.
2. Has a DC component.	2. No DC components.	2. No DC components.	2. May of may not have DC component.
3. Poor sync for long 0.	3. Better sync than Unipolar.	3. Better sync for long 1.	3. Good sync due to frequent transition.

B

NRZ-L	NRZ-I
1. 0 = +ve, 1 = -ve	1. 1 = Inversion, 0 = No inversion
2. Sync is poor for long 0 and 1.	2. Sync better for long 1.

C

NZR	ZR
1. Singal is constant for a bit.	1. Returns to zero in the middle.
2. Lower bandwidth.	2. Higher bandwidth due to transition.
3. Sync is poor.	3. Sync is better.
4. May have a DC component.	4. No DC component.
5. Example: NZR-L, NZR-I	5. Example: Man, DMan.

D

Line Coding	Block Coding
1. Encodes individual bits.	1. Encodes a group/block of bits.
2. No redundancy.	2. Redundancy due to error detection and correction.
3. May have sync issue.	3. Better synchronization.
4. Lower bandwidth.	4. Higher bandwidth due to added bits.
5. Example: NZR, Manchester, Bipolar AMI.	5. Example: 4B/5B, 8B/10B.

E

B8ZS	HDB3
1. Works for 8 consecutive zero.	1. Works for 4 consecutive zero.
2. Simpler.	2. More complex.
3. Used in North America.	3. Used in Europe and Japan.

F

Manchester	Differential Manchester
1. 0 = High to Low, 1 = Low to High.	1. 0 = Inversion, 1 = No inversion.
2. Simpler.	2. Slightly complex.

Answer to the Question No. 10

A.

$S_{avg} = N_{avg}$ [for NZR-I]

$S_{avg} = 10$ Mbaud

Minimum bandwidth = S/2 = 10/2 = 5 MHz

B.

$SNR_{dB} = 6.02 * n + 1.76$

$40 = 6.02 * n + 1.76$

n = 6.35 = 7 bits per sample

C.

Extra bits = 1kbps * (0.2/100) = 1000bps * (0.2/100) = 2 bps

For 1Mbps,

Extra bits = 1Mbps * (0.2/100) = 1000000bps * (0.2/100) = 2000 bps

D.

Scheme	Category	Costly? (Yes/No)	Has DC Component problem? (Yes/No)	Has synchronization problem? (Yes/No)	Has baseline wandering problem? (Yes/No)	Signal Rate/ Bandwidth
NRZ	Unipolar	No	Yes	Yes	Yes	N/2 Bd
NRZ-L	Polar	No	Yes	Yes	Yes	N/2 Bd
NRZ-I	Polar	No	Yes	Yes	Yes	N/2 Bd
Manchester	Bi-phase	Yes	No	No	No	N Bd

Differential Manchester	Bi-phase	Yes	No	No	No	N Bd
AMI	Bipolar	No	Yes	Yes	Yes	N/2 Bd
MLT-3	Multitransitional	Yes	Yes	Yes	Yes	N/3 Bd