Department of Electrical Engineering
Final – Term Assignment Spring 2020
Date: 22/06/2020

Course Details

Course Title: Computer Communication Network
Instructor: Waqas Khan
Module: 06
Total Marks: 50

Student Details

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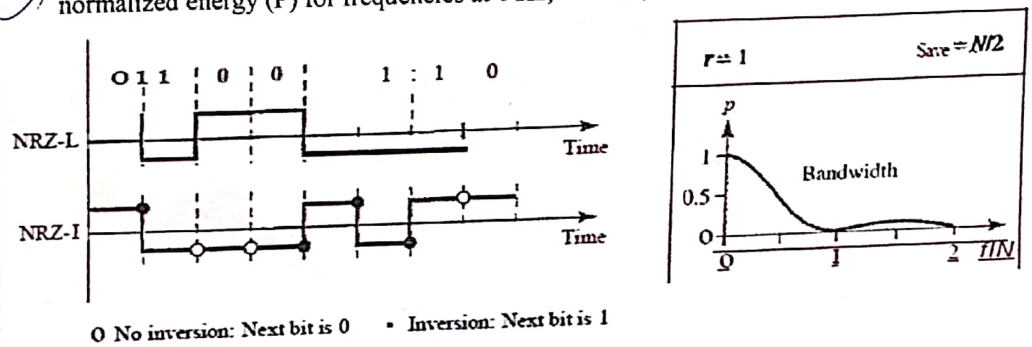
Q1.	(a)	1. An NRZ-I signal has a data rate of 100 Kbps. Using the following Figure, calculate the value of the normalized energy (P) for frequencies at 0 Hz, 50 KHz, and 100 KHz.	Marks 20 CLO 1



		2. What is the Nyquist sampling rate for each of the following signals? a. A low-pass signal with bandwidth of 200 KHz? b. A band-pass signal with bandwidth of 200 KHz if the lowest frequency is 100 KHz? 3. We have sampled a low-pass signal with a bandwidth of 200 KHz using 1024 levels of quantization. a. Calculate the bit rate of the digitized signal. b. Calculate the SNRdB for this signal. c. Calculate the PCM bandwidth of this signal. 4. What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four levels of digital signaling.	
Q2.	(a)	Draw the graph of the NRZ-L, NRZ-I, Manchester and differential Manchester scheme using each of the following data streams a. 01010101 b. 00110011	Marks 16 CLO 1
Q3.	(a)	1. A TV channel has a bandwidth of 6 MHz. If we send a digital signal using one channel, what are the data rates if we use one harmonic, three harmonics, and five harmonics? 2. A signal travels from point A to point B. At point A, the signal power is 100 W. At point B, the power is 90 W. What is the attenuation in decibels? 3. The attenuation of a signal is -10 dB. What is the final signal power if it was originally 5 W? 4. A signal has passed through three cascaded amplifiers, each with a 4 dB gain. What is the total gain? How much is the signal amplified? 5. If the bandwidth of the channel is 5 Kbps, how long does it take to send a frame of 100,000 bits out of this device? 6. The light of the sun takes approximately eight minutes to reach the earth. What is the distance between the sun and the earth?	Marks 12 CLO 1
	(b)	A signal has eight data levels with a pulse duration of 2 ms. Calculate the pulse rate and bit rate.	Marks 02 CLO 1

Hafiz Ayub hassan (1) I.D 6997

Q No: 1

Part (1): An NRZ-I signal has a a data rate of 100 kbps. Using the following figure, calculate the value of the normalized energy (P) for freq at 0 Hz, 50 KHz, and 100 khz.

Sol: Given Data: Data rate: 100 kbps.

for NRZ-I when f/N = 0

Power is taken as 1

(a) Frequency = 0 KHz ⇒ P = 1.

(b) Frequency = 50 KHz ⇒ P = 50 KHz ÷ 100 KHz

$= 0.5 \times 10^{-3}$

(c) Frequency = 100 KHz ⇒ 100 KHz ÷ 100 KHz

= 1

X ———————— X

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(2)

Part : 2

what is the Nyquist rate for each of the following:

(a) A Low-pass Signal with bandwidth of 200 KHz?

In Low-Pass Signal $B = f_{max} = 200 KHz$

Niquist Sampling Rate $= 2 \times 200 KHz$

$= 400000$ Samples/Sec

(b) $f_{Max} = 100 + 200 KHz = 300 KHz.$

Niquist Sampling Rate $= 2 \times 300 KHz.$

$= 600000$ Samples/Sec

X———————X

Part: 3 :

We have sampled a Low-pass Signal with a bandwidth of 200 KHz Using 1024 levels of equation.

(a) Calculate the bit rate of the digitized signal.

$B = f_{max} = 300 \times 10^3$ Hz.

$L = 1024$.

(a) Bit rate $= f_s \times n_b$

$f_s = 2 \times f_{max}$

$n_b = \log_2 1024 \Rightarrow \log_2 2^{10} \Rightarrow 10^5$

$= 2 \times 300 \times 10^3 \times 10$

$=$ 6 Mbps.

(b) calculate the SNR_{dB} for This signal.

$$SNR_{dB} = 6.02 \times n_b + 1.76 \, dB$$

$$= 6.02 \times 10 + 1.76 \, dB$$

$$= 61.96 \, dB$$

(C) Calculate the PCM bandwidth of this Signal.

The value of $n_b = 10$. we Can easily calculate as:

$$B_{PCM} = n_b \times B_{analog}$$

$$= 10 \times 200 KHz.$$

$$= 2 MHz.$$

X ———————— X

Part: 4

What is the Maximum data rate of a channel with a bandwidth of 200 KHz. If we use four Levels of digital Signaling.

Ans: Here bandwidth = 200 KHz
= 200000 Hz.

The Maximum data rate Can be calculated as:

$N_{Max} = 2 \times B \times n_b = 2 \times 200000 \times \log_2 4$

$= 800$ Kbps.

X———————X

Q 2 (a)

Draw the graph of ...... following data streams.

(a) 01010101

(b) 00110011

Sol: NRZ-L.

Average number of changes $(0+0+8+4)/4 = 3$

$N = 8$

So bandwidth is proportional to $3/8\,N$.

(a) Given data bit is 01010101

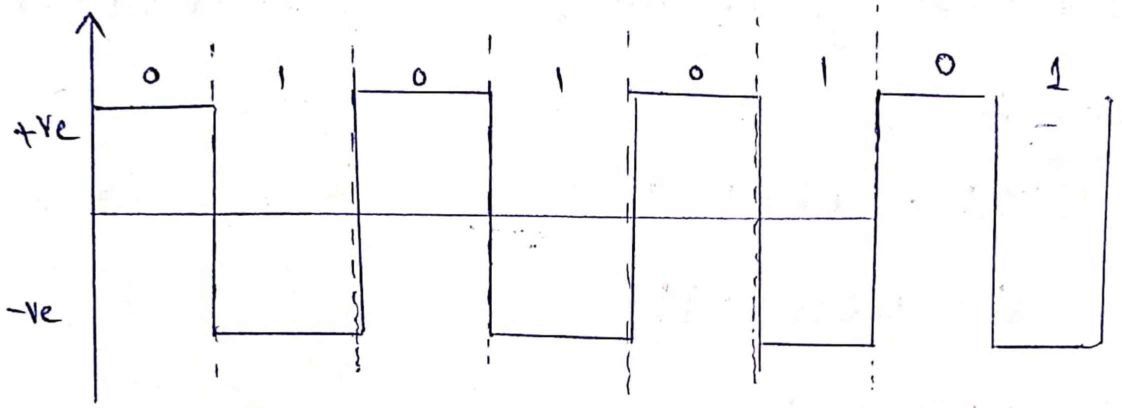
(b) 00110011

In NRZ-L The voltage levels are both sides of the time axis.

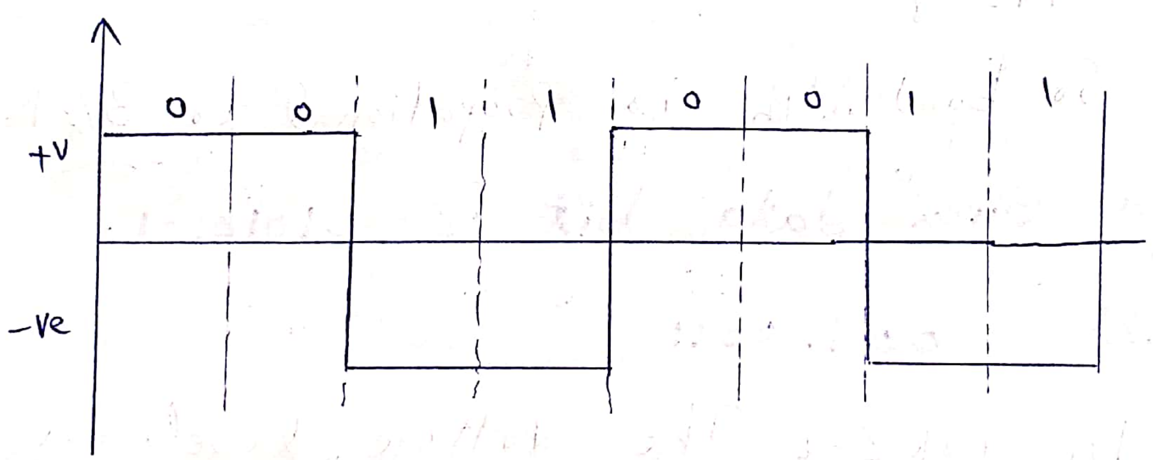
⇒ voltage level +ve = 0

⇒ voltage level -ve = 1.

Graph for :(a) 01010101



for 0 0 1 1 0 0 1 1



NRZ-L has the average signal rate is:

$N/2$ = Means evarage level of changes in the signal level.

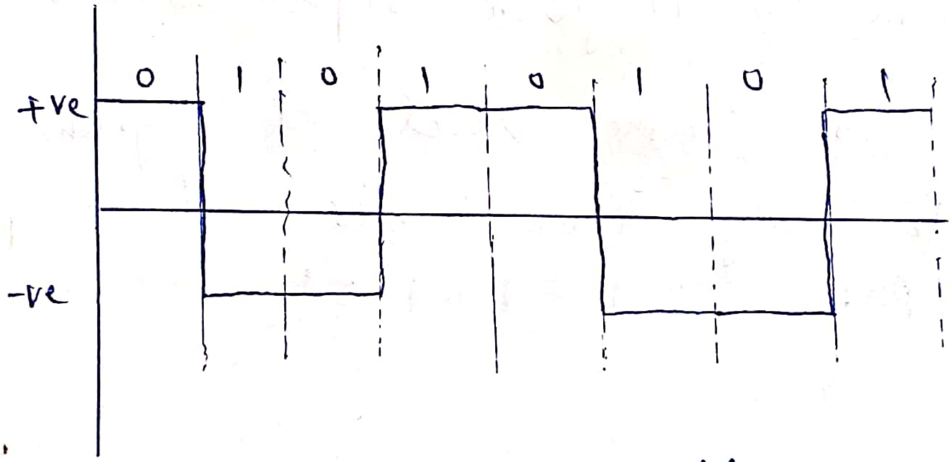
Minimum bandwidth = $B_{Min} = S = N/2$

$$B_{Min} = \frac{N}{2}$$

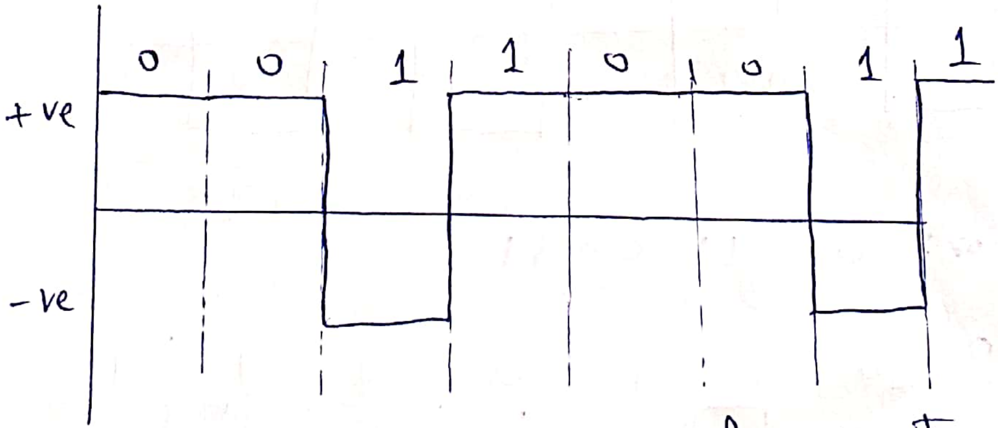
NRZ-I

This is same as NRZ-L but inversion occurs when next bit is 1 otherwise no inversion.

Graph: for 01010101



for 0011 0011



Average signal route of NRZ-I is

$B_{in} = N/2$.

⇒ Manchester Encoding

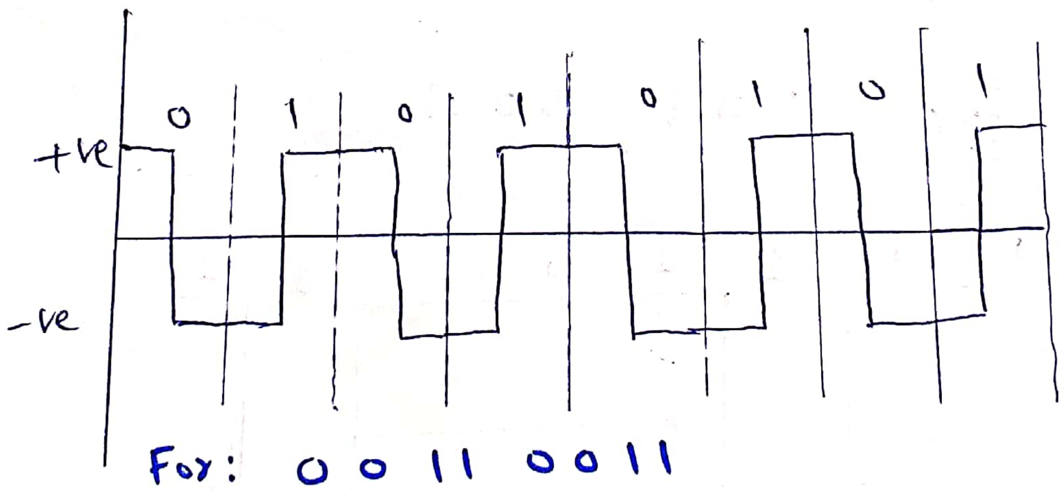
Uses an Inversion at the Middle of each bit Interval for both synchronization and bit representation.

⇒ Negative to Positive represents ⇒ 1

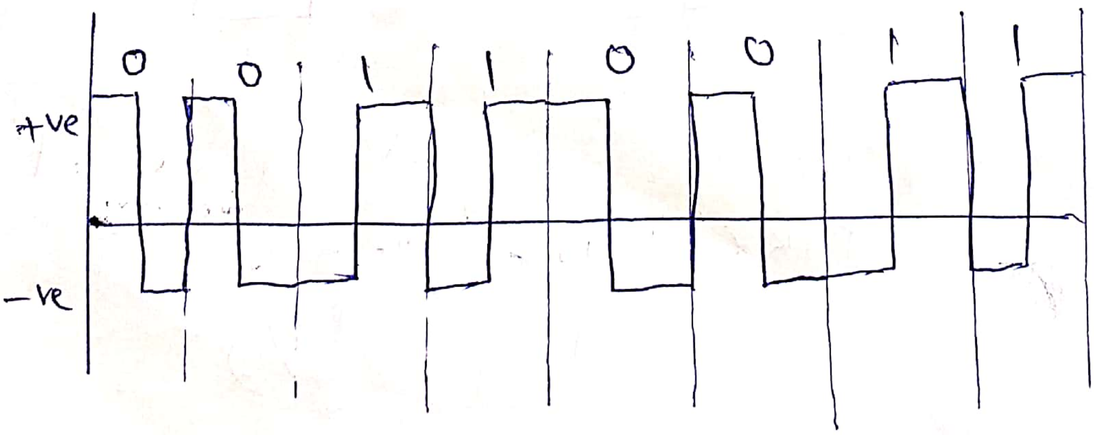
⇒ Positive to Negative represents ⇒ 0.

⇒ Achives same level of Synchronization with only two levels of Amplitude.

Graph: 0 1 0 1 0 1 0 1



For: 0 0 1 1 0 0 1 1



Differential Manchester scheme:

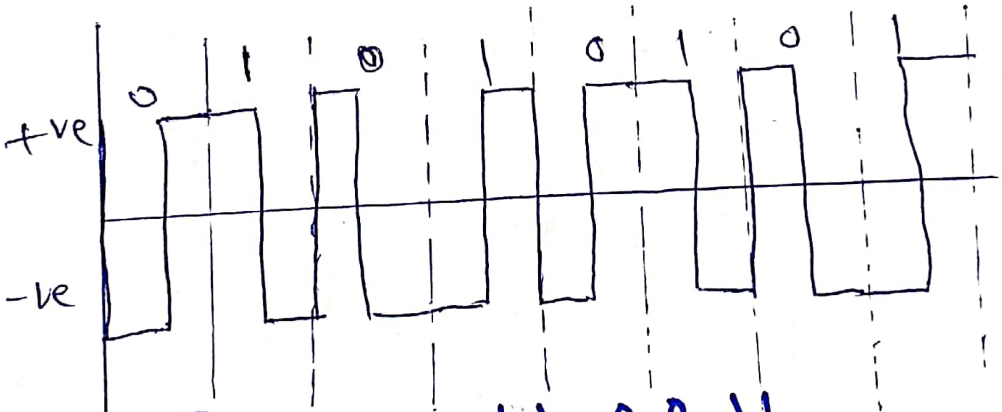
Inversion at Middle of bit Interval is used for Synchronization-

⇒ Transistion Means binary = 0

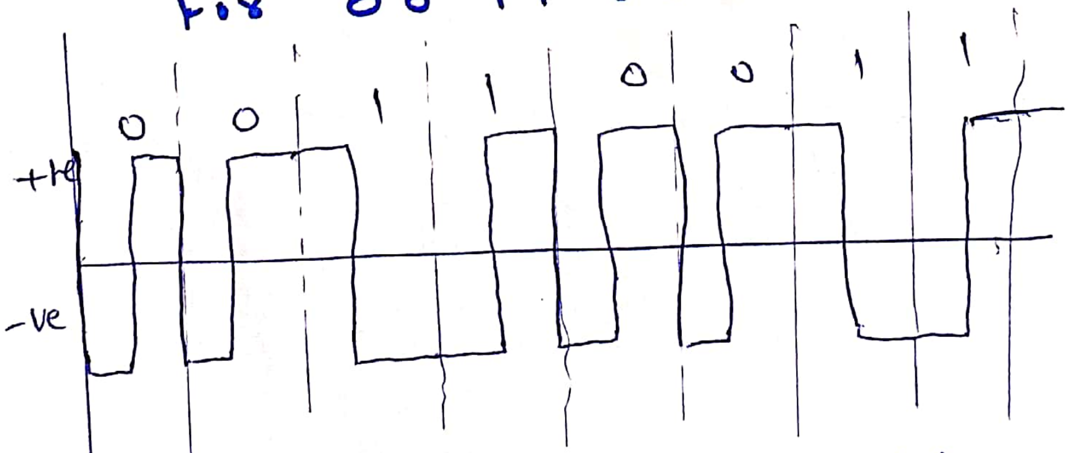
⇒ No Transition Means = 1

Requires two signal changes to Represents ~~cha~~ binary 0 bit Only one to represent 1.

Graph: for 01010101



For 00110011



Q:3 part(1)

A TV chanel has a bandwidth of 6 MHz. .. ---.- Three harmonic, and five harmonic - ?

Sol: BW = 6 MHz.

(1) BW from 0 Hz to first harmonic = 6 MHz.

Bit rate = 2 x first harmonic

= 2 x 6 = 12 Mbps.

(2) BW from 0 Hz To ~~first~~ f3rd harmonic = 6 MHz.

first harmonic = 3 x first harmonic

first harmonic = 6 MHz/3 = 2 MHz

Bit rate = 2x first harmonic

= 2 x 2 ⇒ 4 Mbps.

= 4 Mbps.

1

(3) BW from 0 Hz to ~~first~~ f_{5th} harmonic = 6 MHz.

first harmonic = 6 MHz / 5
= 1.2 MHz.

Bit rate = 2 x first harmonic

= 2 x 1.2
= 2.4 Mbps.

X ———————————— X

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(13)

Q#3 Part (2)

The attenuation (dB) $= 10 \log_{10} B/A$

$= 10 \log_{10} \left(\frac{90}{100}\right)$

$= 10 \log_{10} (0.9)$

~~⊞~~ $\log_{10}(0.9) = 10 \ (-0.046$

$\log_{10}(0.9) = -0.046.$

Attenuation(dB) $= -0.46$ dB.

X ———————————— X

Q No: 3

Part (3)

Ans: The Attenuation is the reduction of strength in the Power of a signal due to external factors. The extent of reduction is Measured in decibel.

Given:

$P_s = 5W.$

Attenuation $= -10\,d_b$

Therefore:

$$-10 = 10 \log_{10} (Pd/5)$$

$$Pd = 10^{-1} \times 5$$

$$\boxed{Pd = 0.5\,W}$$

X ———————————— X

Part: (4)

A Signal has passed Through 3 cascaded amplifier, each with a 4dB gain.

Total gain $(P_{d_b}) = 3 \times 4\ d_B$

$P_{dB} = 12\ d_B$

The signal is amplified than.

$P_{dB} = 10 \log_{10} P$

$P = 10^{\frac{P_{dB}}{10}}$

$= 10^{\frac{12}{10}}$

$P =$ ~~15.85~~ .12

Part : (5)

Bandwidth = 5 kbps = 5000 bps.

It takes time to send a ~~Propos~~ frame of 100,000 bits out of This device $T = \frac{100,000}{5000} \Rightarrow 20s$

$\boxed{T = 20s}$

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(16)

Part (6)

The light of sun takes time to Reach earth = 8 mint.

That is:

8 mint = 8 0 x 6 0 s

= 480 s.

Convert Miles Per Second to Km/s

$= \frac{186000 \text{ Miles}}{\text{Sec}} \times \frac{1 \text{ km}}{0.62 \text{ miles}}$

= 300,000 Km/s

Therefore the difference b/w Sun and earth is = 480 x 300,000

= 144000000 Km/s

X ———————— X

Scanned with CamScanner

Q 3 (b)

A Signal has eight data levels with a pulse duration of 2 ms. calculate the pulse rate and bit rate.

Sol:

$$\text{Pulse rate} = \frac{1}{2 \times 10^{-3}} = 500 \text{ Pulses/s}$$

$$\text{Bit rate} = \text{Pulse rate} \times \log_2 L$$

$$= 500 \times \log_2 8$$

$$= 1500 \text{ bps.}$$

x ———————— x

The end.