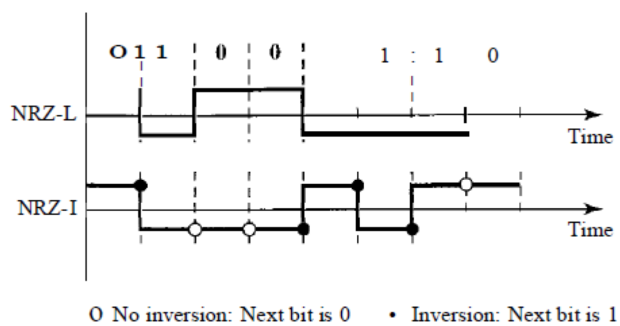
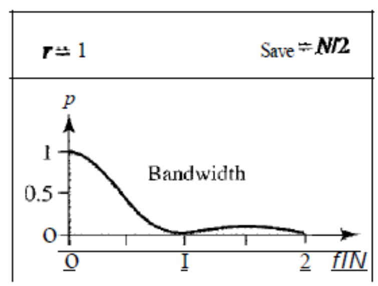
Department of Electrical Engineering
Final – Term Assignment Spring 2020
Date: 22/06/2020

Course Details

Course Title: Computer Communication Network **Module:** 06
Instructor: Engr Muhammad Waqas **Total Marks:** 50

Student Details

Name: Idrees Iqbal **Student ID:** 13171

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.   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.	Marks 20 CLO 1
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

Semester 8th

(1)

Paper CCN . Submitted To Engr. M. Waqas

Name Tafees Iqbal ID 13172

Q No 1

Given data

Data rate $N = 100$ kbps

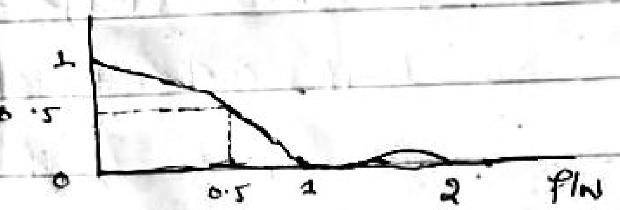
Now first calculate f/N value then after find energy P value by using the given figure.

f = frequency

N = data rate

P = energy per Hz

The given figure is



Case 1: $f = 0$ Hz then $f/N = \frac{0}{100} = 0$

$\frac{f}{N} = 0$, so $P = 1$

Case 2: $f = 50$ KHz then $f/N = \frac{50}{100}$

$= 0.5$

$f/N = 0.5$ so

$P = 2$

Case 2

$f = 50$ KHZ

then

$f/N = \frac{50}{100} = 0.5$

$f/N = 0.5$, so $P = 0.5$

Case 3: $f = 100$ KHZ

then $f/N = \frac{100}{100} = 1$

f/N 1 so $P = 0$

— * — * — * —

Q No 1 part 2 b)

In a band pass signal the minimum frequency is equal to bandwidth plus minimum frequency

$f_{max} = 200 + 100$

$= 300$ KHZ

$= 300 \times 10^3$ Hz

$= 3,00,000$ Hz

There fore

Nyquist rate $= 2 \times F_{max}$

= 2 × 300000

= 6,00,000 Sample/s

QNo#1 part 2 (a)

Given data

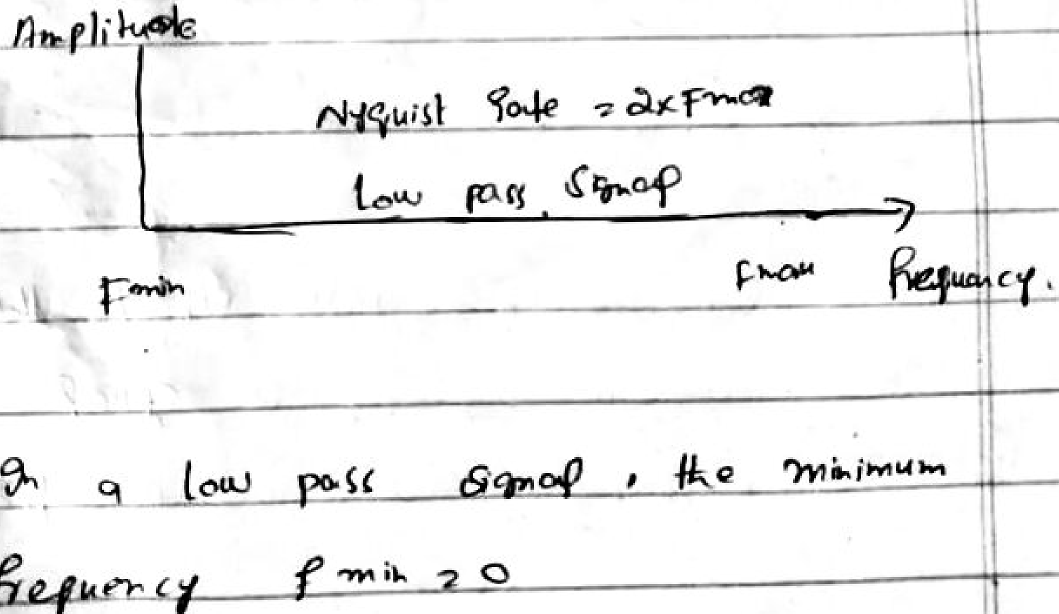
A low pass signal with

bandwidth = 200 KHZ

= 200×10^3 HZ

= 200,000 HZ

Nyquist Rate



In a low pass signal, the minimum frequency $f_{min} = 0$

Therefore the Nyquist Rate = $2 \times f_{max}$

= 2 × 2,00,000

= 4,00,000 Sample/s

QNo #1 part 3

a)

Bit rate = sampling rate × number of bits per sample

= Fs × nb

$n_b = \log_2 1024 = 10$ bits

$f_s = 2 \times 200$ KHZ = 400 KHZ

Bit rate = Fs × nb

= 400 × 10

= 4 mbps

(b) $SNR_{db} = 6.02\, n_b + 1.76$ db

= $6.02 \times 10 + 1.76$

= $60.2 + 1.76$

SNR = 61.96

(c) $B_{min} = nb \times B_{analog}$

B analog represent the bandwidth of analog signal

$B_{min} = 10 \times 200$ KHZ

= 2000 KHZ

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Qn- 1 Part 4

Bandwidth 200 KHz = 200,000 Hz

* The maximum data rate can be calculated

N max = 2 × B × nb = 2 × 200000 × log2 4 = 8 × 10^5 bps

= 800 Kbps

Qn. 2 :

We need to draw the graph for

(a) 01010101

(b) 00110011

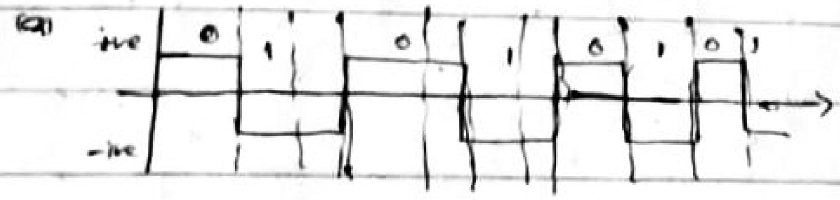
NRZ-L, NRZ-I, Manchester, B-AMI and we need to find the bandwidth.

NRZ-L

In NRZ-L the voltage levels are both sides of the time axis
voltage level +ve = 0
voltage level -ive = 1

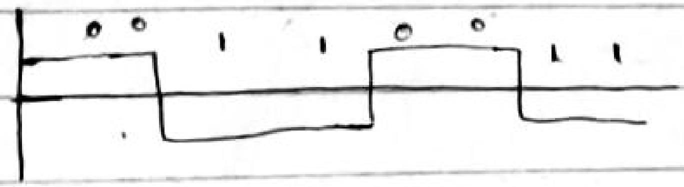
graph for NRZ-L 01010101

(a)



for 00110011

(b)



NRZ-L has a average rate is N/2 mean average no of changes in the signal level.
The minimum bandwidth for average baud rate is

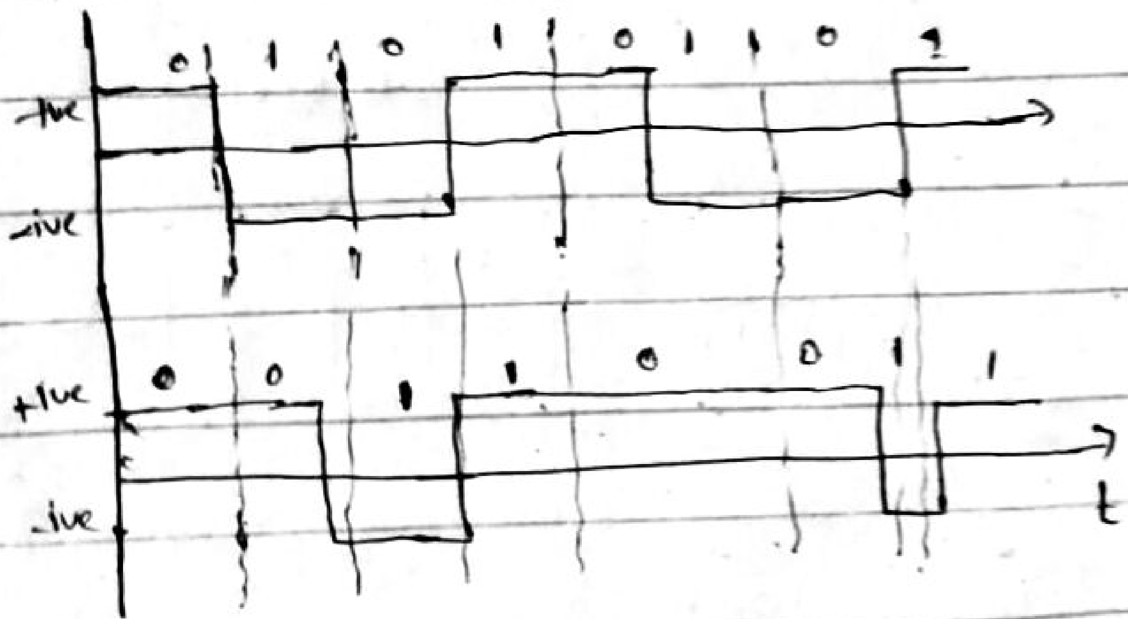
Bmin = S = N/2 N-> bit rate.

Bmin = N/2

NRZ-I

This is same as NRZ-L but inversion occurs when next bit is other with no inversion.

NRZ-I



Average signal rate of NRZ-I is

Q No 3 Part 1

Given data

Tv channel bandwidth (B) = 6MHz
using the first harmonic

$$\text{Bandwidth } (B) = \frac{\text{data rate (bit rate)}}{2}$$

$$\text{Data rate} = 2 \times B$$
$$= 2 \times 6$$

Therefore $\boxed{\text{data rate} = 12\text{Mbps}}$

using the first and three harmonics
A better result can be achieved by using the first and the third harmonics with the required bandwidth (B) = $\frac{3 \times \text{data rate}}{2}$

$$\text{Data rate} = \frac{2 \times B}{3}$$

$$= \frac{2 \times 6}{3}$$

$$= 4\text{Mbps}$$

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Using the 1st and 5th harmonics

$$\text{Bandwidth} = \frac{5 \times \text{datarate}}{2}$$

$$= \frac{2 \times B}{5}$$

$$= \frac{2 \times 6}{5}$$

data rate = 2.4 mbps

Q.No 3 part (2)

$$\text{The attenuation (dB)} = 10 \log_{10} \frac{P_2}{P_1}$$

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

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

$$= 10(-0.046)$$ since

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

Attenuation (dB) = -0.46 dB

1(10)

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Q.No.3 Attenuation is the reduction of Strength in the power of a Signal due to external factors. The extent of reduction is measured in decibels.

Given. $P_S = 5W$

Attenuation = -10 db

Therefore

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

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

$Pd = 0.5W$

Q.No 2 part 4

A Signal has passed through 3 Cascaded amplifiers, each with a 4 dB gain

Total gain (Pdb) = 3×4dB

Pdb = 12dB

The Signal is amplified then

$Pdb = 10 \log \frac{P}{10}$

$P = 10^{\frac{pdb}{10}}$

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$P = 10 \frac{19}{10}$

$P = 12.85$

Q.No 3 part 5

Bandwidth = 5kbps

= 5000 bps

(1kbps = 1000 kbps)

It takes time to send a frame of 100,000 bits out of this device $T = \frac{100,000}{5000}$

$T = 20\ s$

Q.No 3 part b

The light of Sun takes time to reach earth = 8 min
That is

8 mins = 8 × 60 s
= 480 s

Convert miles per second to km/s

$= \frac{186000 \text{ miles}}{\text{sec}} \times \frac{1 \text{ Km}}{0.621 \text{ miles}}$

= 3,00,000 km/s

Therefore the distance b/w Sun and earth is 480 × 300000

= 144,000,000 km/s

Q.N. 3 # b

pulse rate $= \frac{1}{2ms} = 500$ pulse/sec

Bit rate = pulse rate × $\log_2 L$
$= 500 \times \log_2 8$
= 1500