Department of Electrical Engineering

Final – Term Assignment Spring 2020

Date: 22/06/2020

Course Details

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

Student Details

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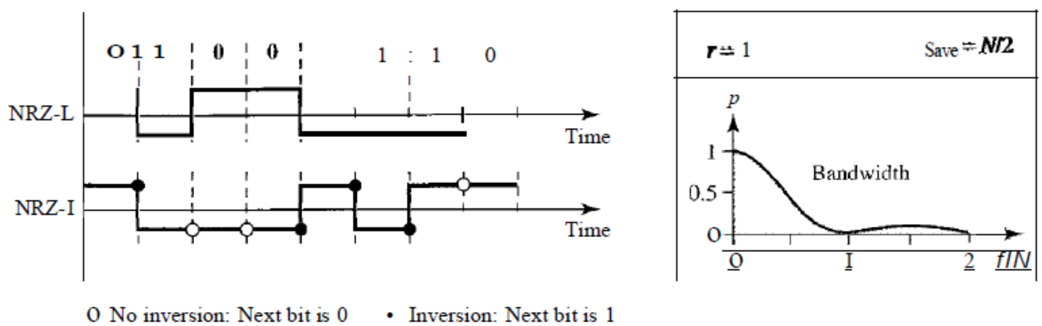
Q1.	(a)	1. An NRZ-I signal has a data rate of 100 Kbps. Using the following Figure, calculate the value of the normalized energy (P) for frequencies at 0 Hz, 50 KHz, and 100 KHz.  2. What is the Nyquist sampling rate for each of the following signals? N nnn a. A low-pass signal with bandwidth of 200 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

IQRA NATIONAL UNIVERSITY PESHAWAR

Final Term

Computer Communication Networking

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Q1:- (Part-a)

★ Solution:-

Data rate = N = 100kbps

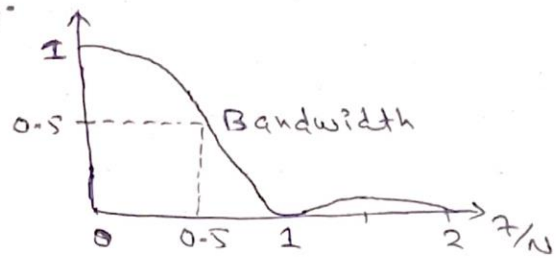
Now first calculate f/N value then find energy P value by using the given figure.

f = frequency

N = data rate

P = energy

Figure:



★ Case 1:-

$f = 0Hz$ then, $f/N = \frac{0}{100} = 0$

$f/N = 0$ so, $P = 1$

★ Case 2:-

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

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

★ Case 3:- $f = 100KHz$

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

$f/N = 1$ so, $P = 0$

Q1:- (Part-2)

★ Solution:- (Part-b)

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

$f_{max} = 200 + 100$

$= 300$ KHz convert it to Hz

$= 300 \times 10^{-3}$ Hz

$= 300,000$ Hz

therefore, Nyquist rate $= 2f_{max}$

$= 2 \times 300,000$

$= 600,000$ sample/sec

Now (Part-a)

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

therefore, the nyquist rate $= 2f_{max}$

$= 2 \times 200,000$

$= 400,000$ sample/sec

★———★———★

Q1:- (Part-3)

★ Solution:- (Part-a)

Bit rate = Sampling rate × number of bits per sample = $f_s \times n_b$

$n_b = \log_2 1024 = 10$ bits

$f_s = 2 \times 200\,kHz = 400\,kHz$

Bit rate $= f_s \times n_b$

$= 400 \times 10$

$= 4$ Mbps

(Part-b)

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

$= (6.02 \times 10) + 1.76$

$= 60.2 + 1.76$

$SNR = 61.96\,dB$

(Part-c) $B_{min} = n_b \times B_{analog}$

B_{analog} represents the bandwidth of analog signal

$B_{min} = 10 \times 200\,kHz$

$B_{min} = 2000\,kHz$

★ —————— ★ —————— ★

Q1:- (Part -4)

★ Solution:-

Band width = 200 KHz

level of signaling (L) = 4

The maximum data rate of a channel = $N_{max} = 2 \times B \times \log_2^{L}$

$= 2 \times 200 \times \log_2^{4}$

$= 400 \times 2$

$= 800$ kbps

★————★————★

★————★

★——★

Q2:- (Part-a)

★ **Solution:-**

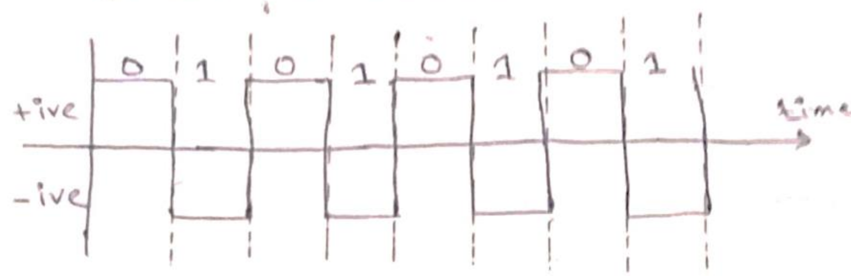
★ **NRZ-L:-** In NRL-Z the voltage levels are both sides of the time axis.

~~For (a)~~

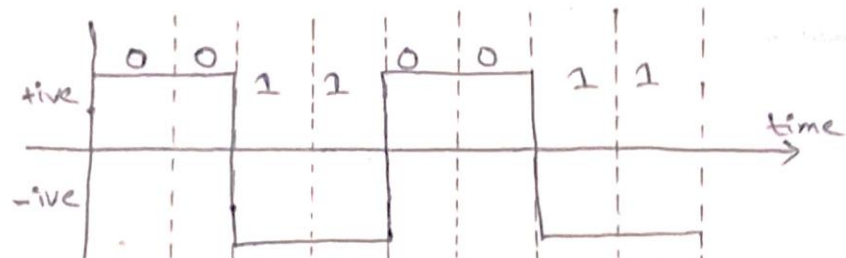
Voltage level +ive = 0

Voltage level -ive = 1

Graph for (a) 01010101



Graph for (b) 00110011



NRZ-L has average signal rate which is = $N/2$ means average no. of changes in the signal level.

the minimum badwidth for average based rate is

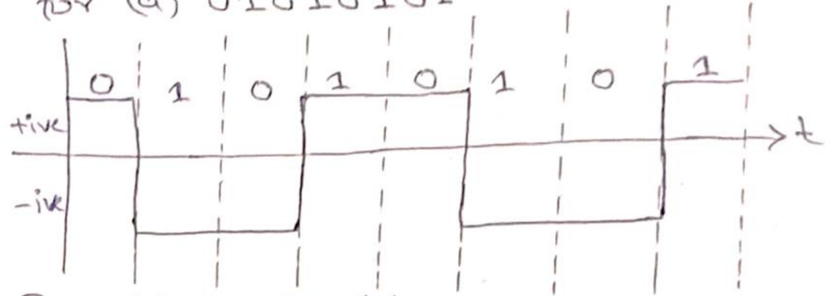
$B_{min} = S = N/2$ $\quad N \rightarrow$ bit rate

$B_{min} = N/2$

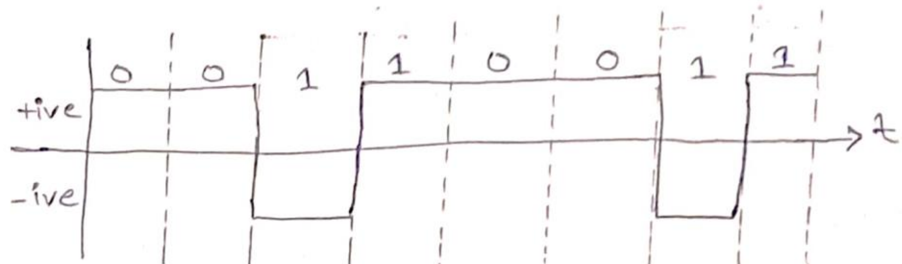
NRZ-I :-

This is same as NRZ-L but invension occurs when next bit is 1, other with no inversion.

Graph for (a) 01010101



Graph for (b) 00110011



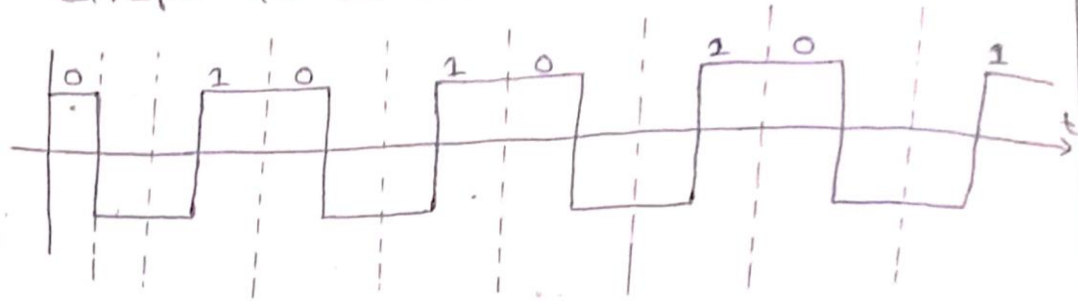
Average rate of NRZ-I is = $N/2$

this is same as NRZ-L but invension occurs when next bit is 1, then other bit with no inversion.

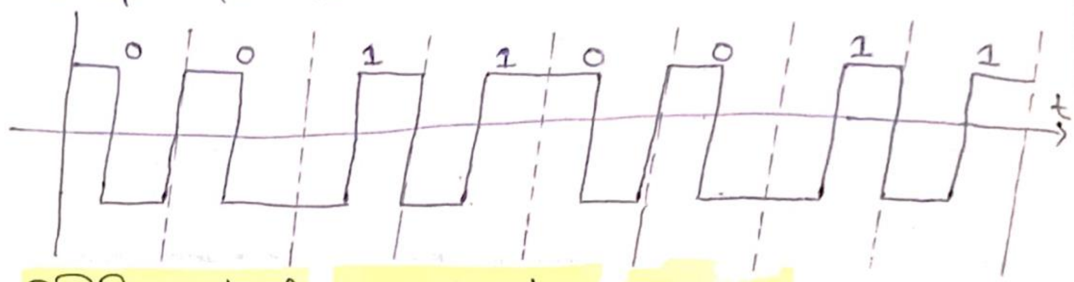
$B_{min} = N/2$

* Manchester Scheme:-

Graph for (a) 01010101

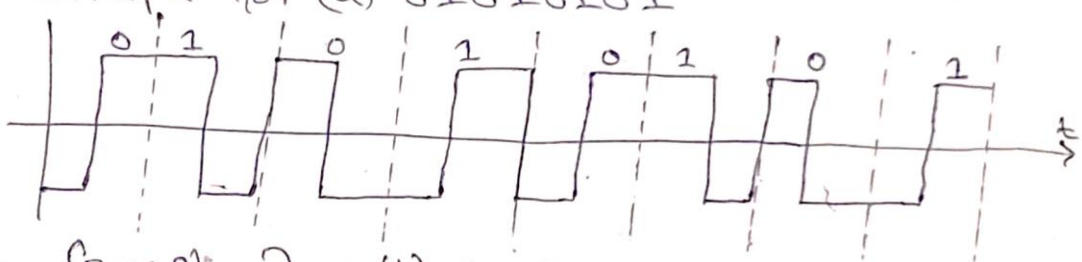


Graph for (b) 00110011

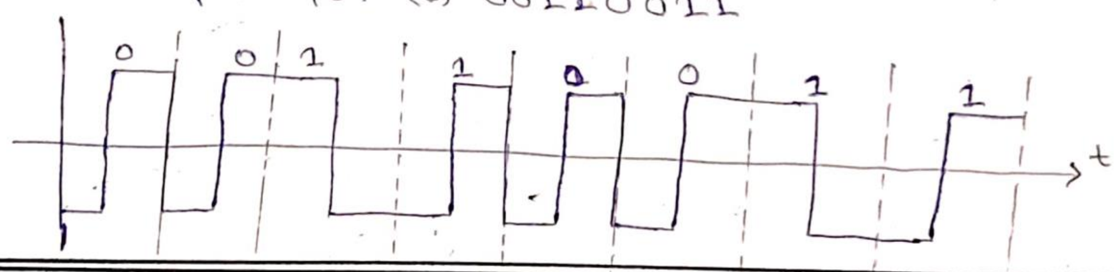


* Differential Manchester Scheme:-

Graph for (a) 01010101



Graph for (b) 00110011



Q3:- (Part - 1)

★ Solution:-

As we know from given data

BW = 6MHz

Then,

→ BW from 0Hz to first harmonic = 6MHz

Bit rate = 2 * first harmonic = 2×6

= 12Mbps

→ BW from 0Hz to third harmonic = 6MHz

f_{3rd} harmonic = 3 × f_{1st} harmonic

f_{1st} harmonic = 6MHz/3

= 2MHz

Bit rate = 2 × f_{1st} harmonic = 2×2

= 4Mbps

→ BW from 0Hz to f_{5th} harmonic = 6MHz

f_{1st} harmonic = 6MHz/5 = 1.2MHz

Bit rate = 2 × f_{1st} harmonic

= 2 × 1.2

= 2.4Mbps

Q3:- (Part - 2)

★ Solution:- The attenuation (dB) = $10 \log_{10} \frac{B}{A}$

Put values

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

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

$= 10(-0.046)$

~~theory~~

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

$= 10 \times -0.046$

$= -0.46\,dB$

★ **Result:-**

So, atteneuation in decibels $= -0.46dB$

★————★————★

Q3:- (Part - 3)

★ **Solution:-**

Attenuation is the reduction of strength in the power of a signal due to external factors.

The extent of reduction is measured in decibels.

As given $P_s = 5W$

Attenuation $= -10dB$

therefore,

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

where $P_d = 10^{-1} \times 5$

So, $P_d = 0.5W$

Q3:- (Part-4)

★ **Solution:-**

As we know that

total gain (P_{dB}) = 3×4 dB

$P_{dB} = 12$ dB

when the signal is amplified then,

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

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

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

$$= 10 (1.2) = 12$$

So, $P = 12$ dB

★————★————★

Q3:- (Part-5)

★ **Solution:-**

As given

Bandwidth = 5 kbps = 5000 bps

∵ 1 kbps = 1000 bps

Now to find the time it takes

So, $T = \frac{\text{bits}}{\text{bps}} = \frac{100,000}{5000}$

$T = 20$ s

Q3:- (Part-6)

* Solution:-

As given

The light of sun takes time to reach earth = 8min

So, in seconds = 8min = 8×60s = 480s

As we know the speed of light = 186000 miles/sec

Convert it int km

So, it will become

300,000 km/s

So, the distance b/w sun & earth

~~is = 144,000,000 km~~

= 480 × 300,000

= 144,000,000 km

distance = 144,000,000,000 m

————————*

Q3:- (Part-b)

* Solution:-

As we know that

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

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

$$= 500 \times \log_2 8 \Rightarrow 500(12.4)$$ ∵ L → levels(8)

Bit rate = 1200