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

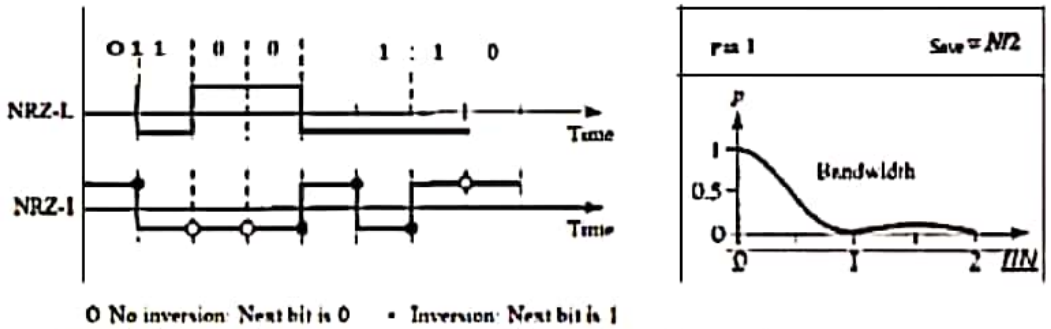
Course Details

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

Yasir Ahmad 13788

Student Details

Name: _____ **Student ID:** _____

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.  0 No inversion: Next bit is 0 • Inversion: Next bit is 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.	Marks CLO
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 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 CLO 1
	(b)	A signal has eight data levels with a pulse duration of 2 ms. Calculate the pulse rate and bit rate.	Marks CLO 1

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Yasir Ahmed
13788

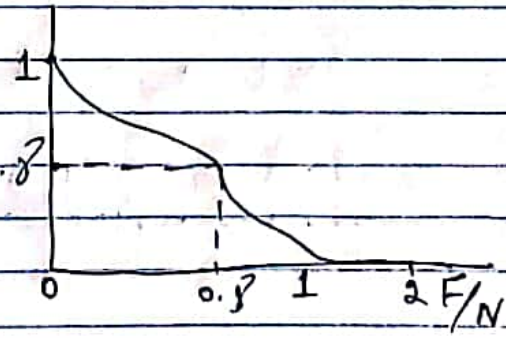
Q1(a)

Ans

The Data rate is 100Kbps.

For each case, we calculate first the value of F/N then use the given digure to find P (energy per Hz).

All calculation are Approximations.



Ans

a) $F/N = 0/100 = 0$

$P = 1.0$ Ans

b) $F/N = 50/100 = 1/2$

$P = 0.5$ Ans

c) $F/N = 100/100 = 1$

$P = 0.0$ Ans.

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Q1(a2) 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 100kHz?

Ans In a low pass signal the minimum frequency 0. Therefore:

$f_{max} = 0 + 200 = 200$ kHz

$f_s = 2 \times 200,000 = 400,000$ Samples/s

In a band pass signal, the maximum frequeny is equal to the minimum frequeny plus the bandwidth i.e have

$f_{max} = 100 + 200 = 300$ kHz

$f_s = 2 \times 300,000 = 600,000$ Samples/s

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Q1(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 ~~the bit rate~~ SNRdB for this signal.

c. Calculate the PCM bandwidth of this signal.

Ans

a. Calculate the lowpass signal, the minimum frequency is 0. Therefore, we can say

$f_{max} = 0 + 200 = 200$ kHz →
$f_s = 2 \times 200,000 = 400,000$ samples/s The number of bits per sample and the bit rate are
$n_b = \log_2 1024 = 10$ bits / sample
$N = 400$ kHz $\times$ 10 = 4 Mbps

b. The value of $n_b = 10$. we can easily calculate the value of SNR dB SNRdB $= 6.02 \times n_b + 1.76 = 61.9$

c. The value of $n_b = 10$. The minimum bandwidth can be calculated as
$B_{PCM} = n_b \times B_{analong} = 10 \times 200$ KHz
$= 2$ MHz

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Q1 (a)

Ans: In low-pass signal B = Fmax = 200 KHz
Nyquist Sampling Rate = 2 x 200 KHz =
400000 Samples per Second

(b) a) Fmax = 100 + 200 KHz = 300 KHz Nyquist Sampling Rate = 2 x 300 KHz = 600000 Samples per Second. a. In low-pass Signal B = fmax = 200 KHz Nyquist Sampling Rate = 2 x 200 KHz = 480000 Samples per Second

b) b) Fmax = 100 + 200 KHz = 300 KHz Nyquist Sampling Rate = 2 x 300 KHz = 600000 Samples per Second

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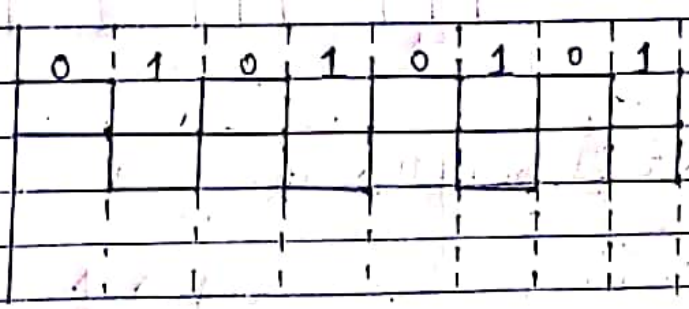
Q2(a) Draw the graph of the NRZ-L, NRZ-I Manchester and differential Manchester scheme using each of the following Data streams.

a) 01010101 b.) 00110011

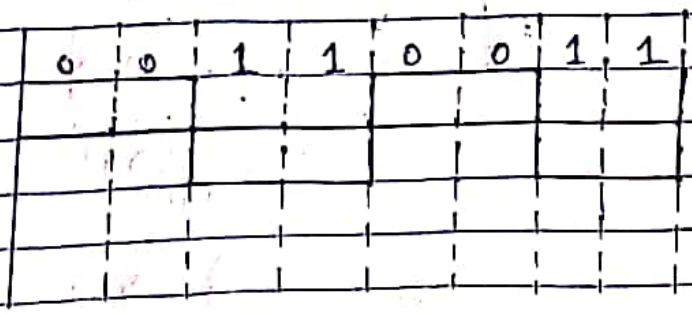
Ans

a) Average number of changes = (8+4)/2 for N=6

a) 01010101 NRZ-L scheme



(b.) 00110011



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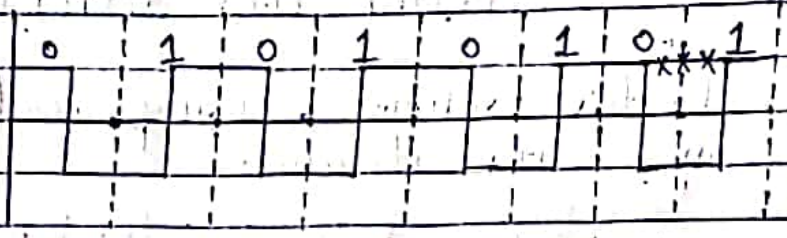
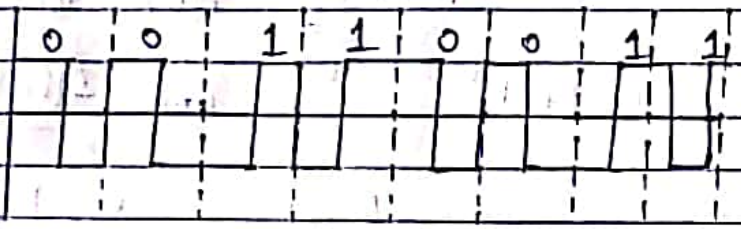
= Repeat Exercise 15 for the Manchester scheme.

a) 01010101

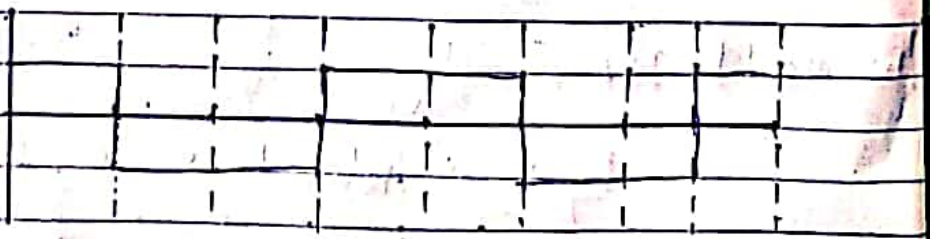


b) ~~antipod~~ 00110011

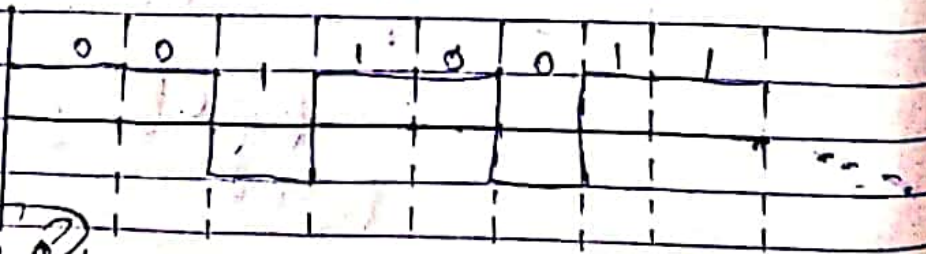


NRZ-I scheme

a)
01010101



b)
00110011



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Ch3 (1)

Q6 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?

Ans BW = 6 MHz

1) BW from 0 Hz to f 1st harmonic = 6 MHz; Bit rate = 2 * f 1st harmonic = 2 * 6 = 12 Mbps

2) BW from 0 Hz to f 3rd harmonic = 6 MHz; f 3rd harmonic = 3 * f 1st harmonic; f 1st harmonic = 6 MHz / 3 = 2 MHz Bit rate = 2 * f 1st harmonic = 2 * 2 = 4 Mbps

3) BW from 0 Hz to f 5th harmonic = 6 MHz; F 1st harmonic = 6 MHz / 5 = 1.2 MHz Bit rate = 2 * F 1st harmonic = 2 * 1.2 = 2.4 Mbps

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Q3 (2)

Ans

$10 \log_{10} (100/90)$

$= \log \log_{10} (1.11)$

$= 1.81$ dB. Ans

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Q3 (3).

Ans Attenuation is the reduction of stregth in the power of a signal due to External factor.

The Extend of reduction is measured in decideb.

Given Data

Power Signal = 5w

Attanuation = -10 db

There fore

$$-10 = 10\log_{10}(Pd/5^2)$$

$$Pd = 10^{-1} \times 5^2$$

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

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Q1(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

The maximum data rate can be calculated as:

$N_{max} = 2 \times b \times n_b = 2 \times 200\ kHz \times \log_2 4 = 800\ kbps$

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Q3 (4)

Ans)

A signal has passed through 3 cascaded Amplifier each with a 4dB gain

Total gain (PdB) = 3 x 4 dB

Pdb = 12 dB

The signal is Amplified then

$$PdB = 10 \log_{10}$$

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

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

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

$$P = 15.8 J$$

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Yasir Ahmed
13788

Cl3 (5)

Ans

Bandwidth = 5 Kbps
= 5000kbps

1Kbps = 1000 Kbps

If takes time to send a frams of 100,00 bits out of this device. T =

$$= \frac{100,000}{5000}$$

$$T = 20s$$

$$\therefore T = 20s \text{ Ans}$$

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Q3 (b)

Ans

The light of Sun taken time to reach earth
= 8 min

That is
8 mint = 8 x 60s
= 480s

Convert miles per second to Km/s

$$= \frac{186000 \text{ miles}}{\text{sec}} \times \frac{1 \text{ km}}{0.62/\text{miles}}$$

= 3,00,000 Km/s

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

= 144,000,000 Km/s

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Q3(b)

Pulse rate Duration = $\frac{1}{2ms}$ = 800 pulse/sec

Bit rate = pulse rate $\times \log_2 L$

$= 800 \times \log_2 8$

Bit rate = 1500 Ans

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Q3 (2)

The Attention (dB) $= 10 \log_{10} \frac{B}{A}$

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

$= 10 \log_{10} 0.9$

$= 10(-0.046)$ since

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

Attenuation (dB) $= -0.46$ dB. Ans

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