NAME : SherDaraz Khan

ID : 13976

PAPER : Computer Communication Network

SUBJECT :

DEPARTMENT : BE(E) 6Th Semester

SEMESTER :

DATE : 22/6/2020

SUBMITTED TO

Engr.Waqas khan

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

Course Details

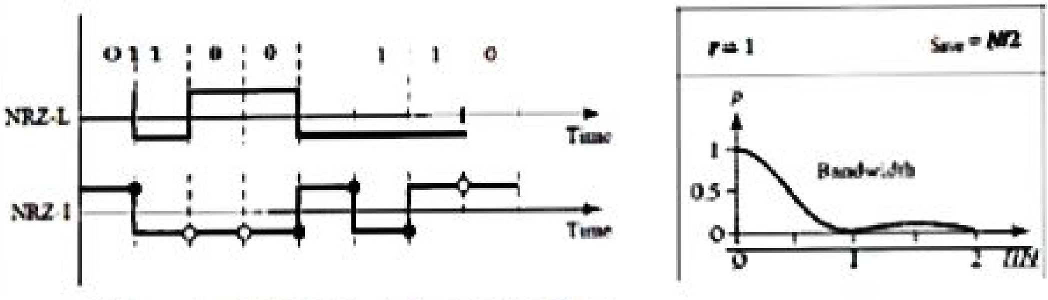
Course Title: Computer Communication Network **Module:** 06
Instructor: **Total Marks:** 50

Student Details

Name: sher daraz khan **Student ID:** 13976

Q1. (a) — Marks 20, CLO 1

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.



O 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.

Q2. (a) — Marks 16, CLO 1

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

Q3. (a) — Marks 12, CLO 1

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?

(b) — Marks 02, CLO 1

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

Q1 ANSWER

Part (a)

(1)

Solution:

The data rate is 100 Kbps. For each case, we first need to calculate the value f/N. We then use in fig in the text to find P (energy per Hz). All calculations are approximations.

(a) $f/N = 0/100 = 0 \rightarrow P = 1.0$

(b) $f/N = 50/100 = 1/2 \rightarrow P = 0.5$

(c) $f/N = 100/100 = 1 \rightarrow P = 0.0$

---

(2)

(a) **Solution:**

Here Bandwidth = 200 KHz = 200,000 Hz

we know that, in a low-pass signal, the minimum frequency = 0

$\therefore f_{max} = 0 + 200000 = 200000$ Hz

$\Rightarrow f_s = 2 \times 200000 = 400000$ Samples/Sec

(b) **Solution:** Here, the lowest frequency = 100 KHz = 100 000 Hz And Bandwidth = 200 KHz = 200000 Hz

$\therefore f_{max} = 100000 + 200000 = 300000$ Hz

$\Rightarrow f_s = 2 \times 300000 = 600000$ Samples/s.

---

(3)

Solution:

(a) Calculate the bit rate of digitized Signal.

Solution:

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

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

$f_s = 2 \times 200{,}000 = 400{,}000$ Samples/Sec

The number of bits per sample & the bit rate are

$n_b = \log_2 1024 = 10$ bits/Sample $N = 400\,KHz \times 10$

$= 4$ mbps

(b) Calculate the SNRdB for this signal:

The value of $n_b = 10$ we can easily Calculate the value of SNRdBSNRdB =

$= 6.02 \times n_b + 1.76 = 61.96$

(c) Calculate the PCM bandwidth of this Signal:

The value of $n_b = 10$ the minimum bandwidth can be calculated as

$B_{PCM} = n_b \times B_{analog} = 10 \times 200\,KHz = 2MHz$

Q1/ANS/

(4)

Solution:

Here, bandwidth = 200KHz = 200000 Hz

∴ The maximum data rate can be calculated as

$N_{max} = 2 \times B \times n_b = 2 \times 200000 \times \log_2 4 = 8 \times 10^8 \, bps$

$= 800 \, Kbps$

Q:2 ANSWER

Part (a):

(a) 01010101

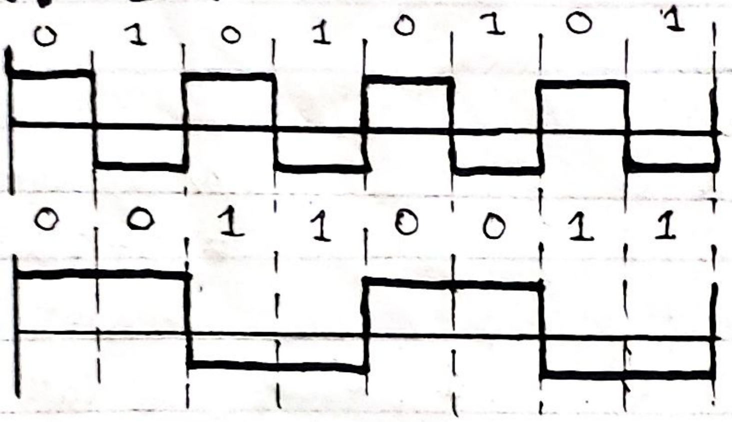
(b) 00110011

DRAW NRZ-L, NRZ-I, MACHESTER & DIFFERENTIAL MANCHESTER:

(i) NRZ-L:

(a)

(b)



Average No. of Changes $= 8+4/2 = 12/2 = 6$

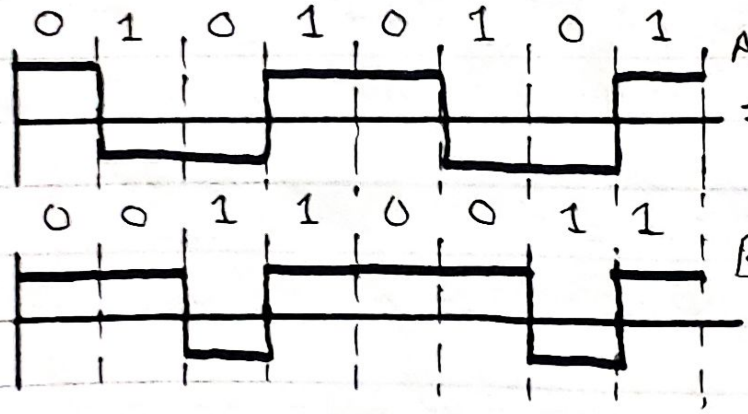
for $N = 8$

Bandwidth, $B = (3/8)N$

(ii) NRZ-I:

(a)

(b)

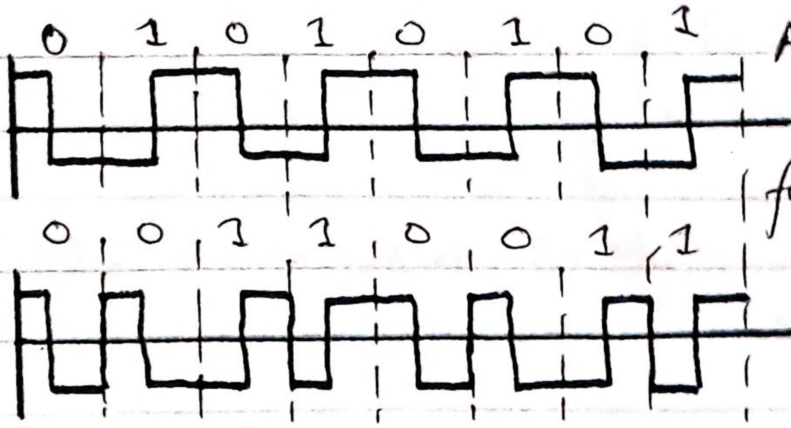


Average No of Changes $= 4+4/2 = 8/2 = 4$

for $N = 8$

Bandwidth, $B = (4/8)N$

(iii) MANCHESTER



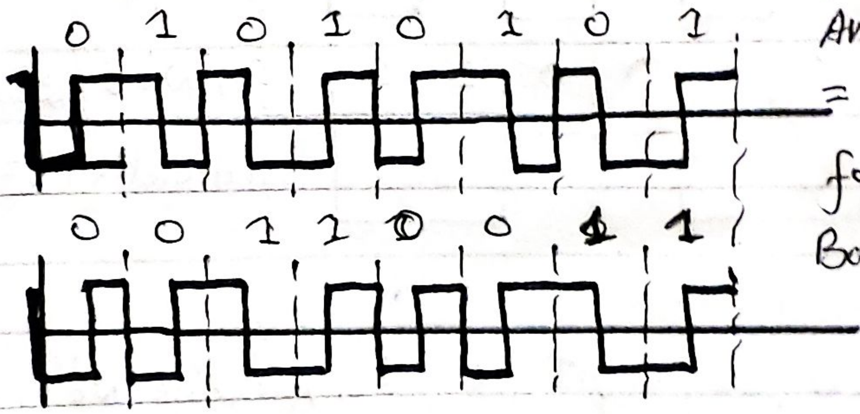
Average Number of changes

$= 8+12/2 = 16/2 = 8$

for $N = 8$

Bandwidth, $B = 8/8 = (1)N$

(iv) DIFFERENTIAL MANCHESTER



Average Number of changes

$= 12+12/2 = 24/2 = 12$

for $N=8$

Bandwidth, $B(12/8)N$

Q3 / ANSWER /

Part (a)

(1)

Solution:

BW = 6MHz

1) BW from 0 Hz to first Harmonic = 6 MHz
Bit rate = 2 * first Harmonic = 2×6 = 12 Mbps

2) BW from 0 Hz to f3rd Harmonic = 6 MHz
f3rd harmonic = 3 × f1st harmonic
f1st harmonic = 6MHz/3 = 2 MHz
Bit rate = 2 × f1st harmonic = 2×2 = 4 Mbps

3) BW from 0 Hz to f5th harmonic = 6 MHz
f1st harmonic = 6 MHz/5 = 1.2 MHz
Bit rate = 2 × f1st harmonic = 2×1.2 = 2.4 Mbps

---

(2)

Solution:

$$dB = 10\log_{10}\left(\frac{90}{100}\right) = -0.046\ dB$$

---

(3)

Solution:

$$dB = 10\log_{10}\frac{P_2}{P_1} \longrightarrow -10 = 10\log_{10} P_2/5$$

$$\log_{10}\frac{P_2}{5} = -1 \Rightarrow P_2/5 = 10^{-1}$$

$$\rightarrow P_2 = 0.5\ W$$

(4)

Solution:

Total gain = 4dB + 4dB + 4dB = 12dB

For power gain of the first stage:

$$4dB = 10 \times \log_{10} P_2/P_1$$

$$P_2/P_1 = 10^{(4/10)} = 2.512$$

For power gain of three stages:

$$2.512 \times 2.512 \times 2.512 = 15.851$$

OR

$$12 dB = \log 10\ P_4/P_1 \rightarrow P_4/P_1 = (10^{(12/10)}) = 15.85$$

---

(5)

GIVEN:

Bandwidth 5000 bps, Frame 100,000 bit

Solution:

⇒ 100,000 b / 5000 bps = 20 sec

---

(6)

Solution :

The velocity (speed) of light is given to us as

$$s = 3 \times 10^8 \ m/s,$$

and the time taken for a light ray to travel from the sun to the earth is :

$$t = 8.3 \text{ minutes} = 8m \times 60 \ s = 498 \text{ sec}$$

Above, we converted the time from mintes to seconds so as to be consistent with the speed of light, which is given in meters per second. Now we may directly calculate the distance traveled by this ray is :

$$d = s \times t$$
$$= 3 \times 10^8 \ m/s \times 498 \text{ sec}$$
$$= 1.494 \times 10^{11} \ m$$

This is the distance b/w the earth & the sun.

Q 3 ANSWER

PART (b)

Solution:

LEVEL = 8

Pulse duration = 2

Find pulse rate & Bit rate = ?

Pulse Rate = 1/2ms = 500 pulses per second

Bit Rate = Pulse Rate × $\log_2 L$

= $500 \times \log_2 8$ = 500×3

Bit Rate = 1500 bps ∵ $\log_2 8 = 3$

END