CPEG 572 Data and Computer Communications

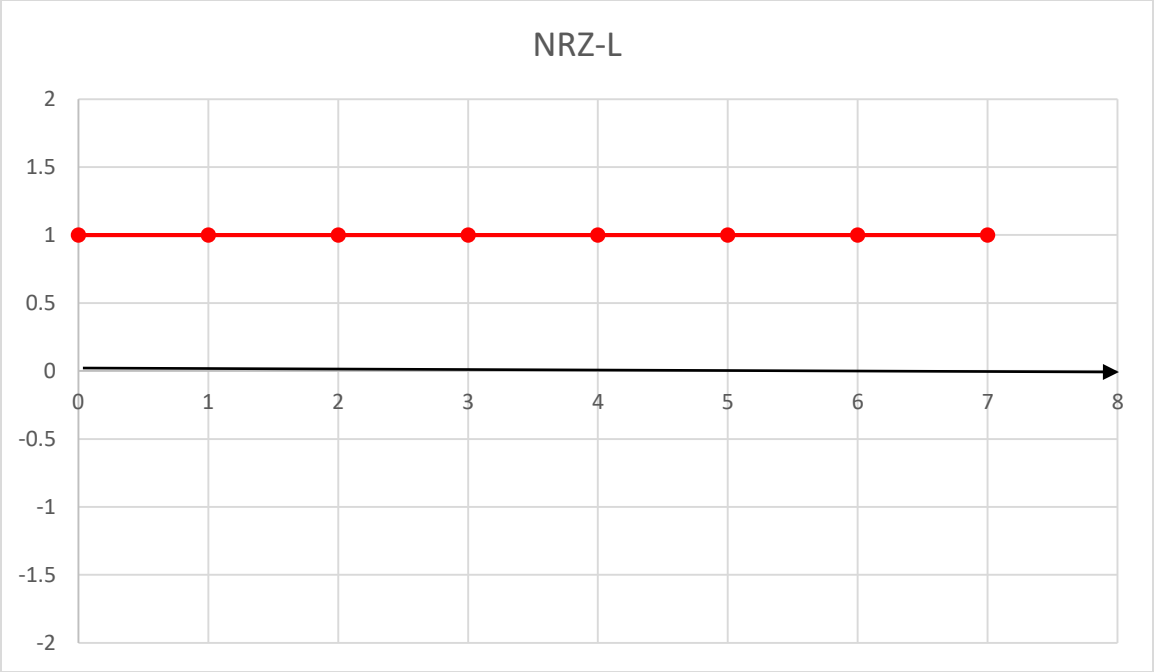
ASSIGNMENT #3

CH 4

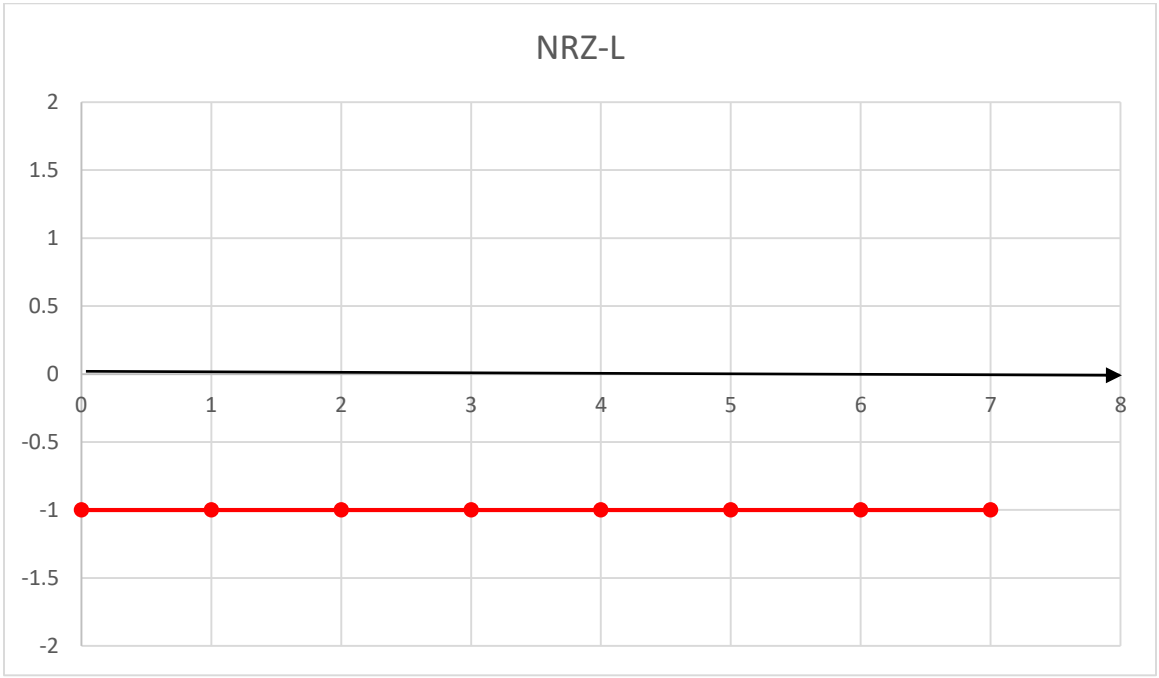
Q.1

Draw the graph of the NRZ-L scheme using each of the following data streams, assuming that the last signal level has been positive.

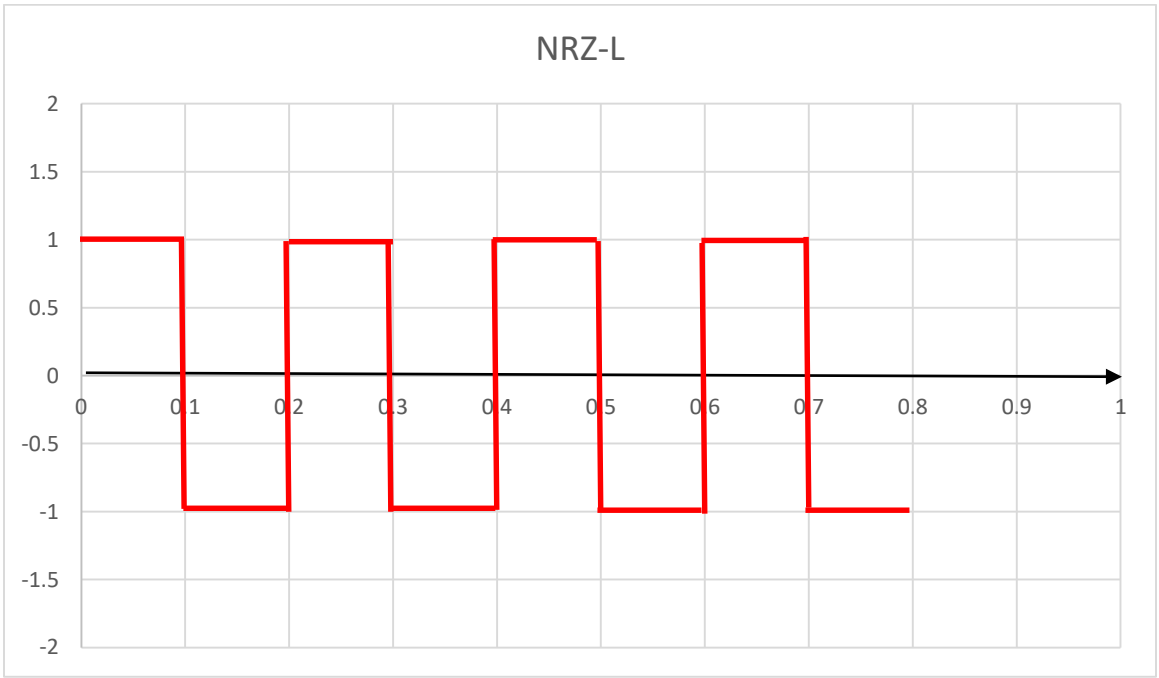
a. 00000000



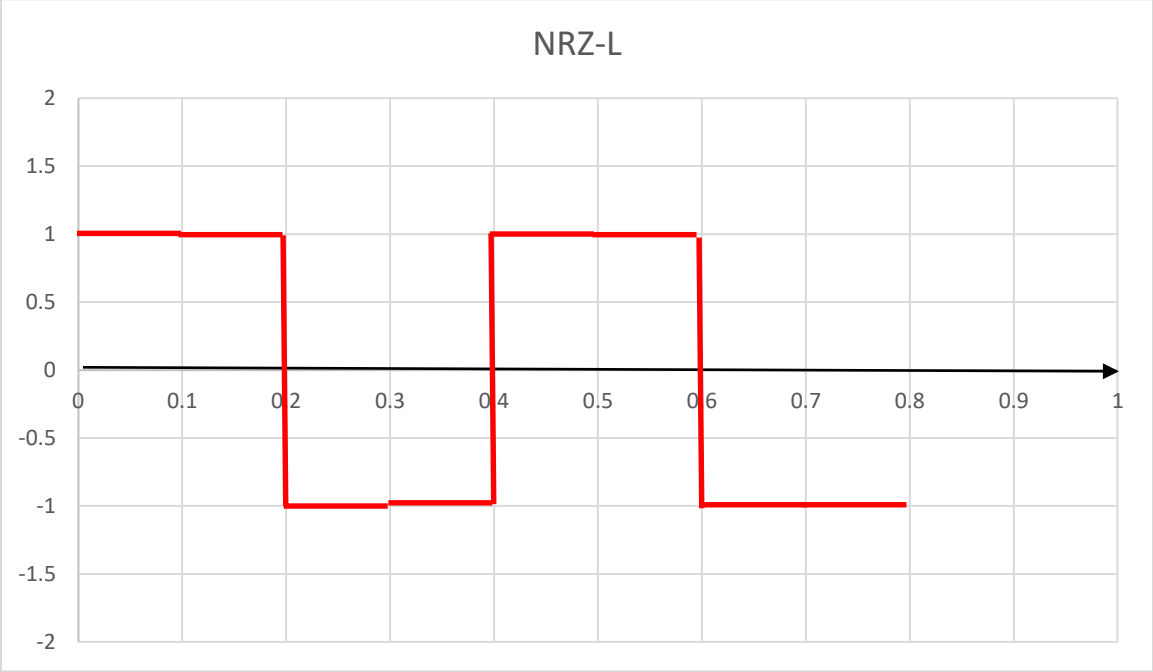
b. 11111111



c. 01010101



d. 00110011



From the graphs, guess the bandwidth for this scheme using the average number of changes in the signal level.

The average number of changes = $\frac{0+0+8+4}{4} = 3$

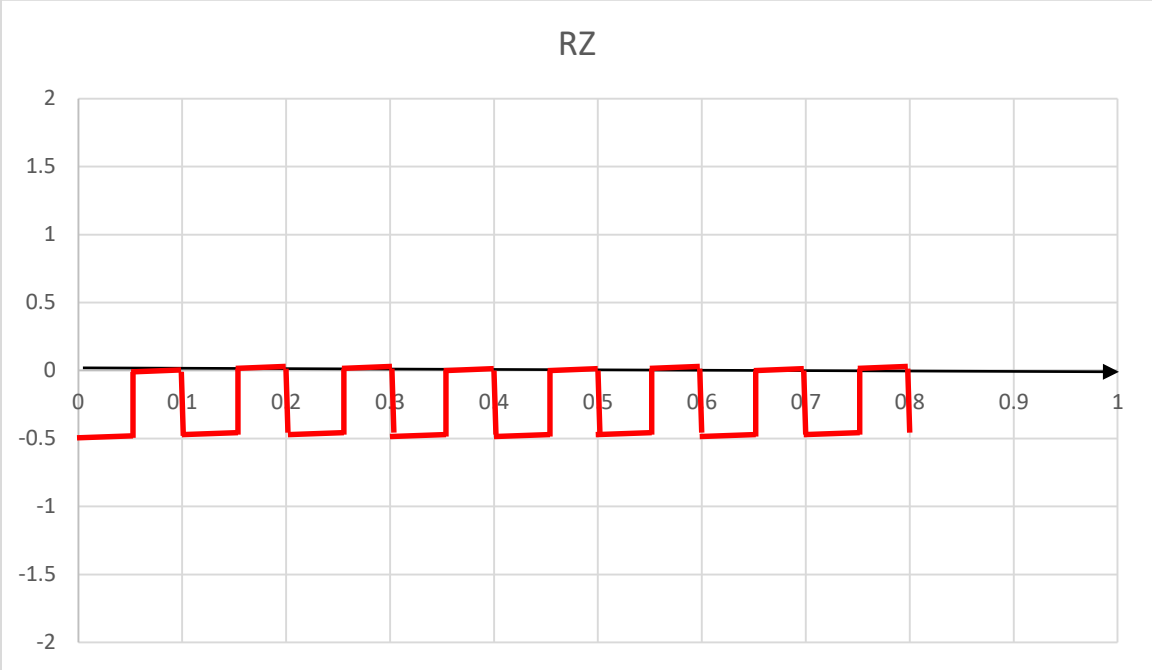
Since, each sequence has 8 data elements which means the data rate (N) = 8.

Thus, the Band width (B) = $\frac{3}{8}$

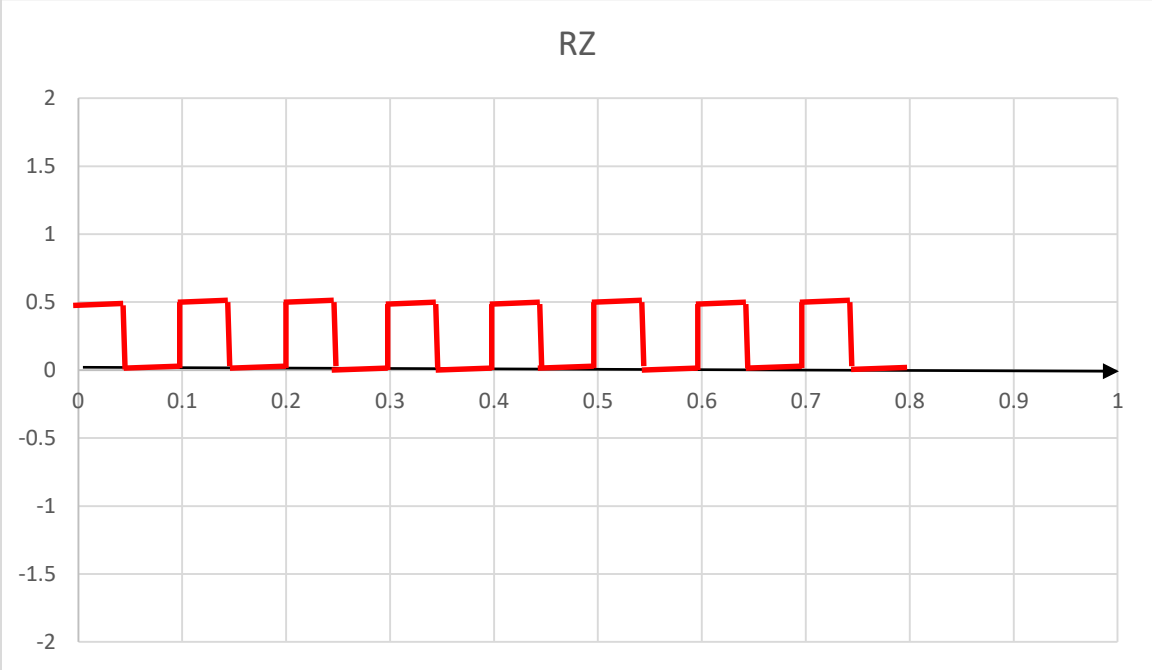
Q.2

Repeat Q1 for

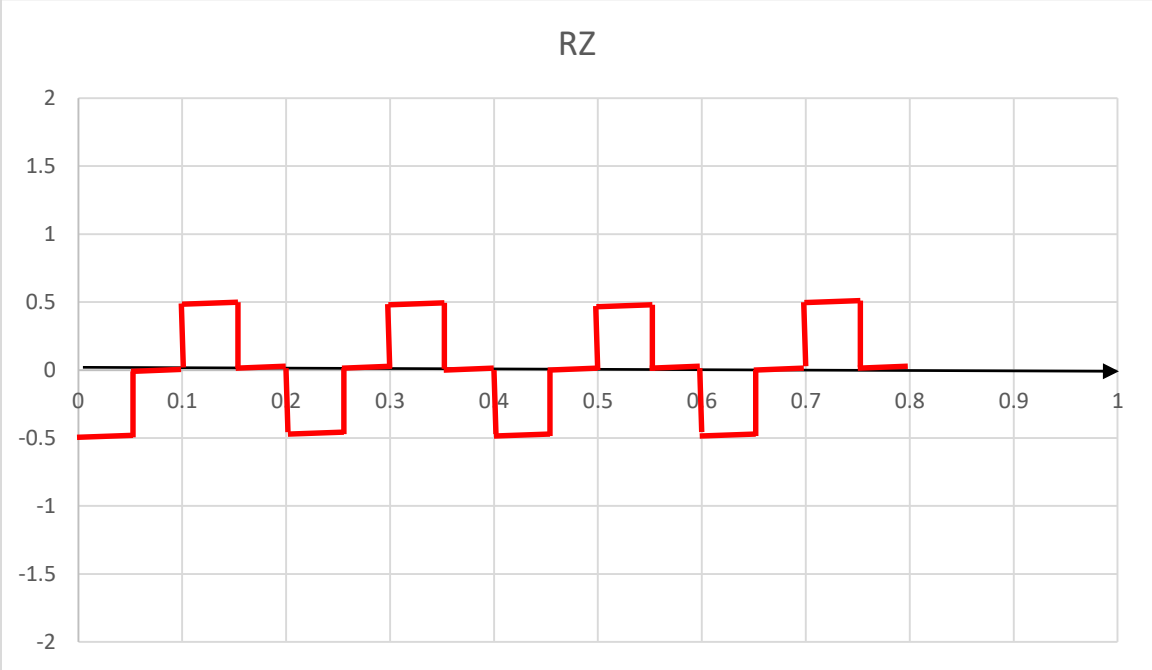
a. RZ scheme.
00000000



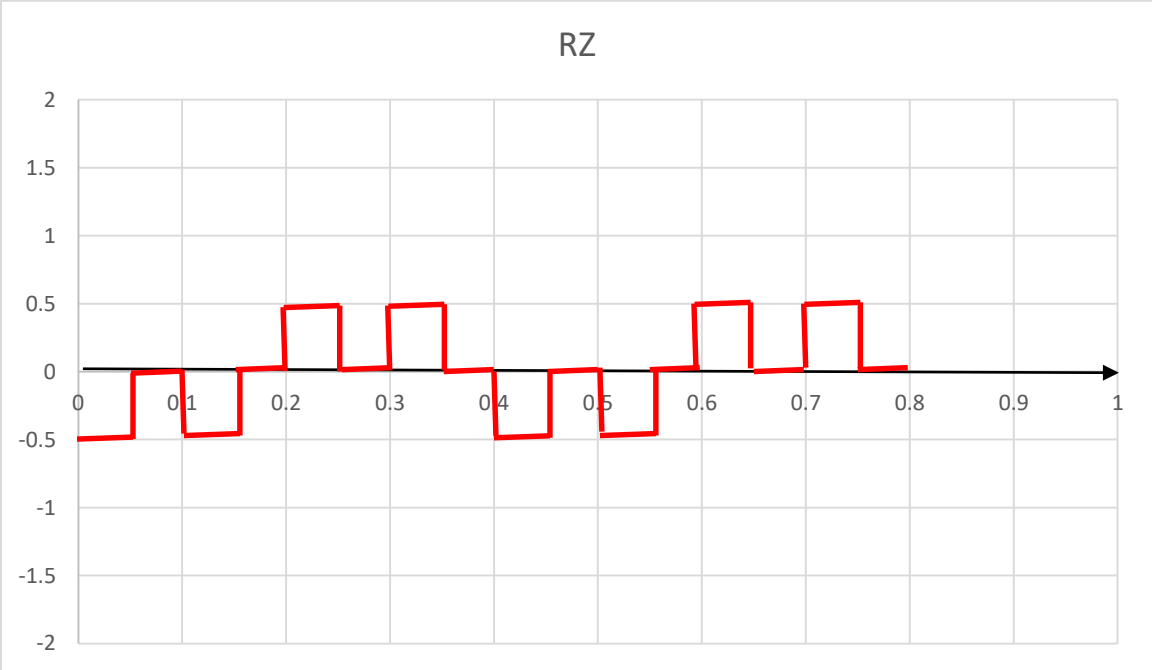
11111111



01010101



00110011



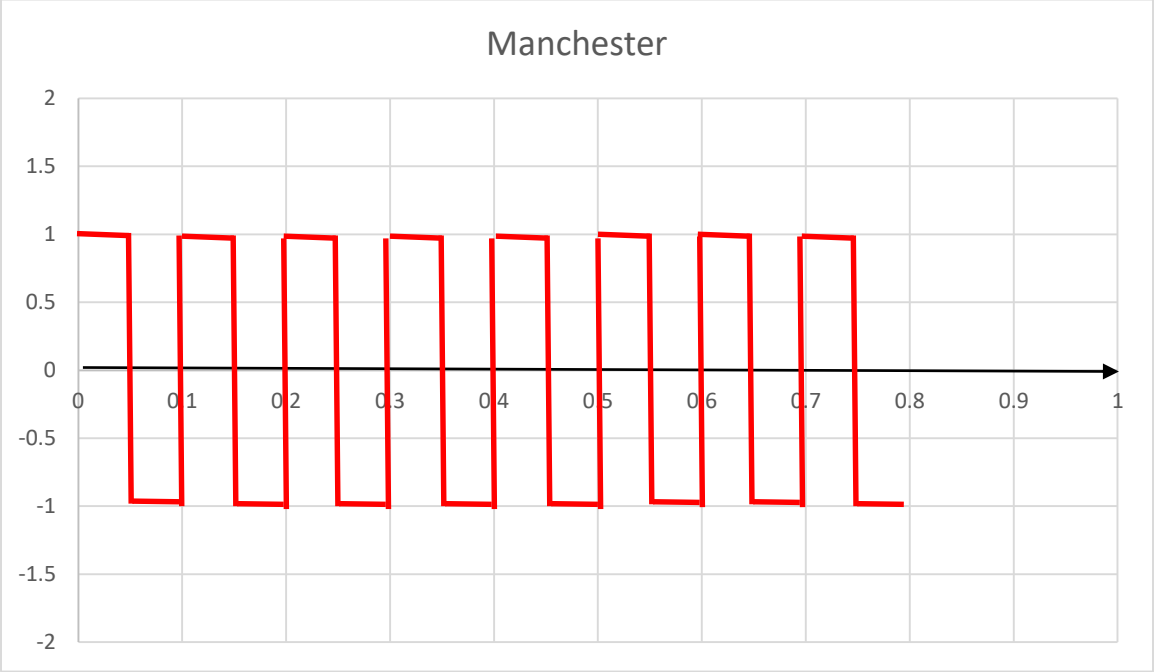
The average number of changes = $\frac{15+15+15+15}{4} = 15$

Since, each sequence has 8 data elements which means the data rate (N) = 8.

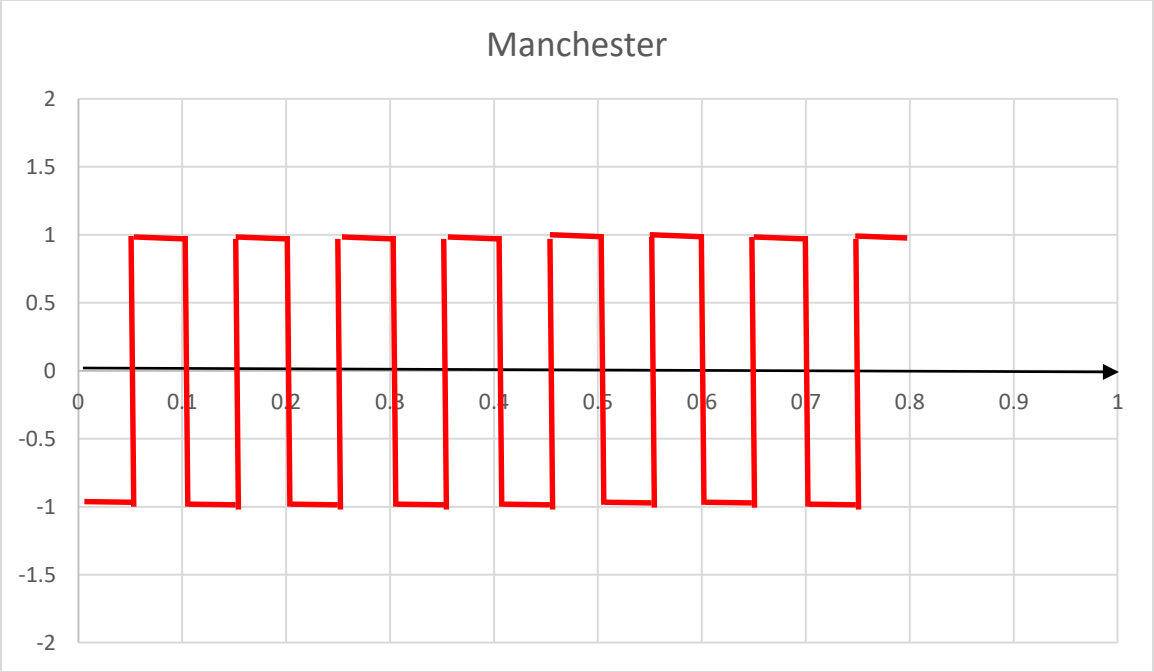
Thus, the Band width (B) = $\frac{15}{8}$

Manchester scheme.

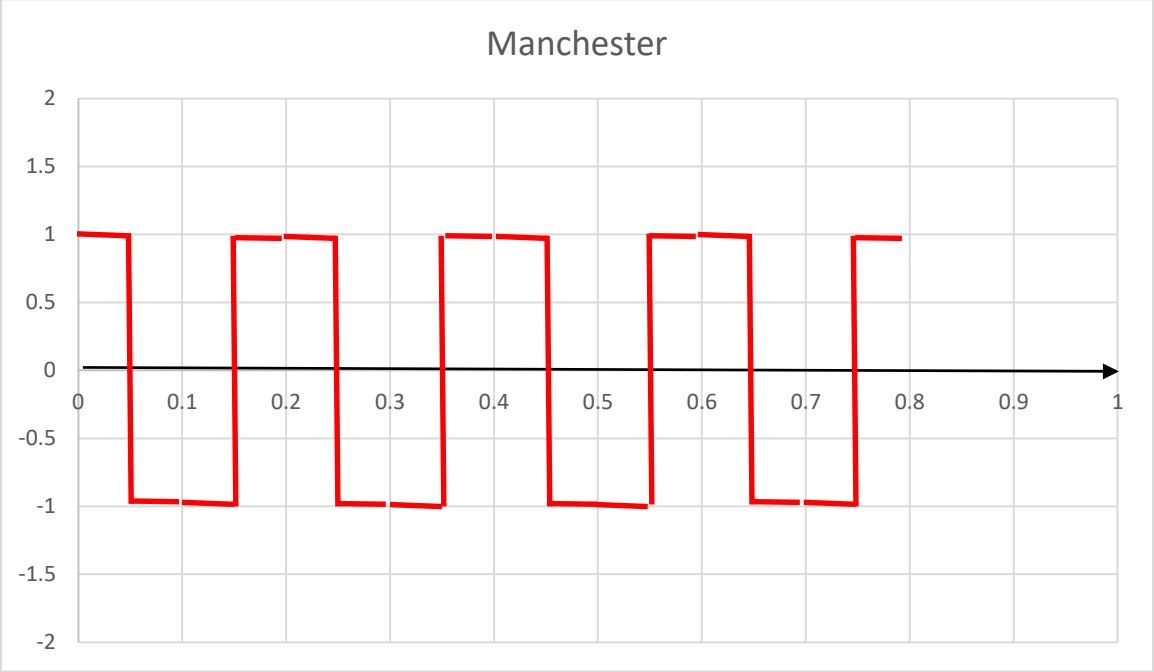
00000000



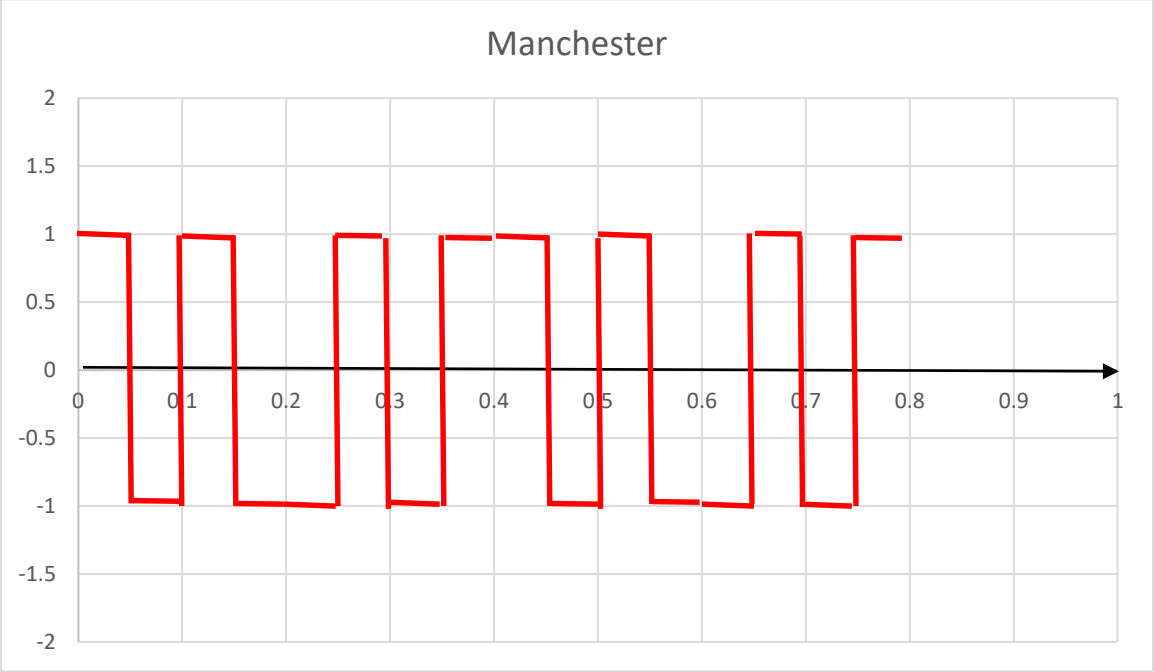
11111111


Manchester
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

01010101


Manchester
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

00110011



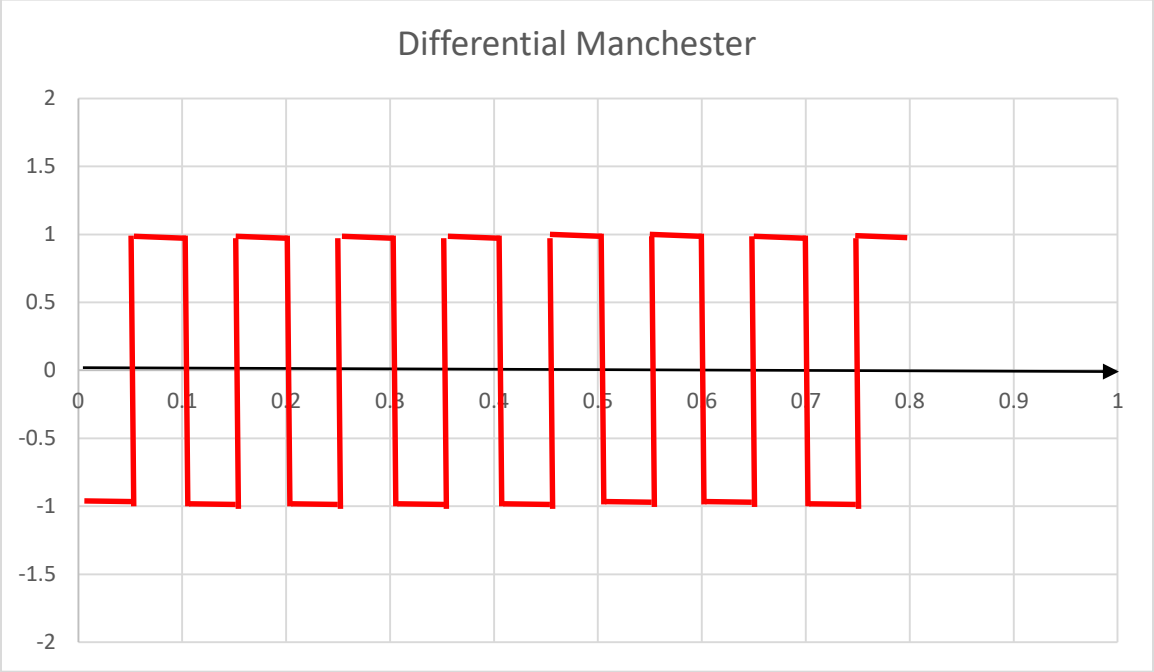
The average number of changes = $\frac{15+15+8+12}{4} = 12.5$

Since, each sequence has 8 data elements which means the data rate (N) = 8.

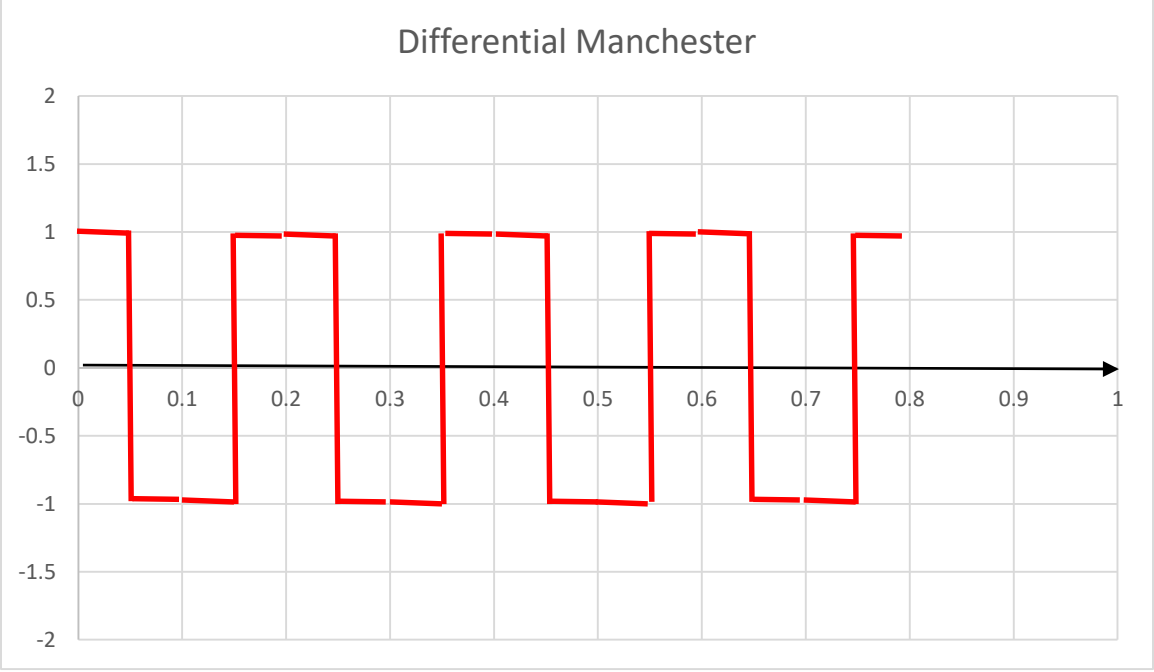
Thus, the Band width (B) = $\frac{12.5}{8}$

b. Differential Manchester scheme

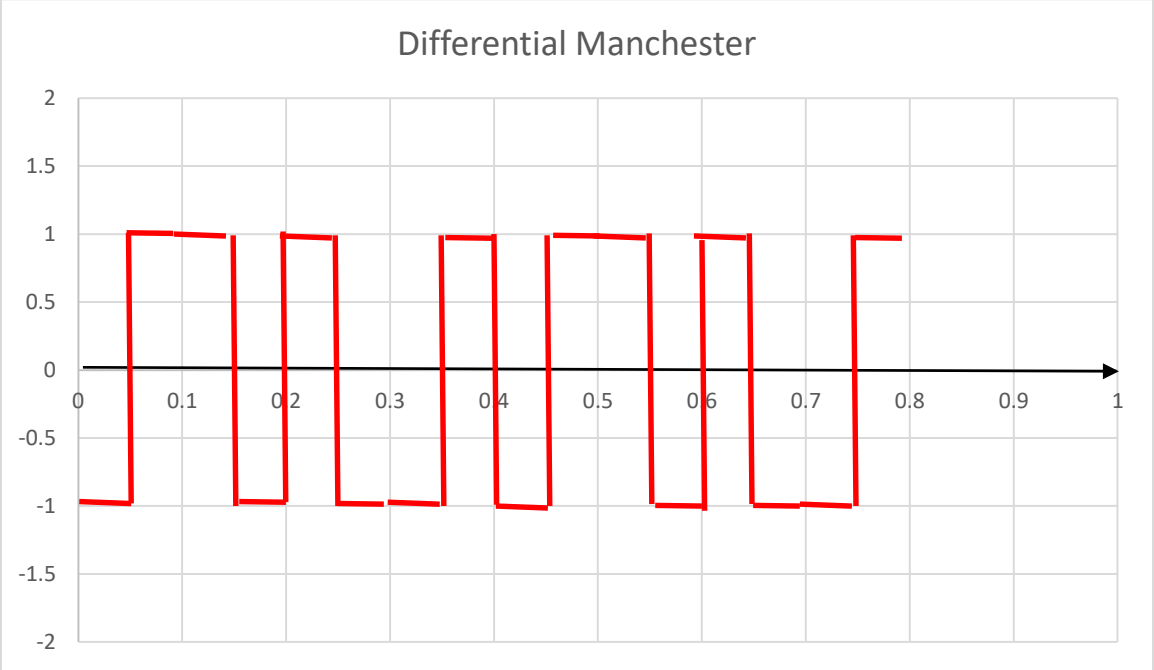
00000000



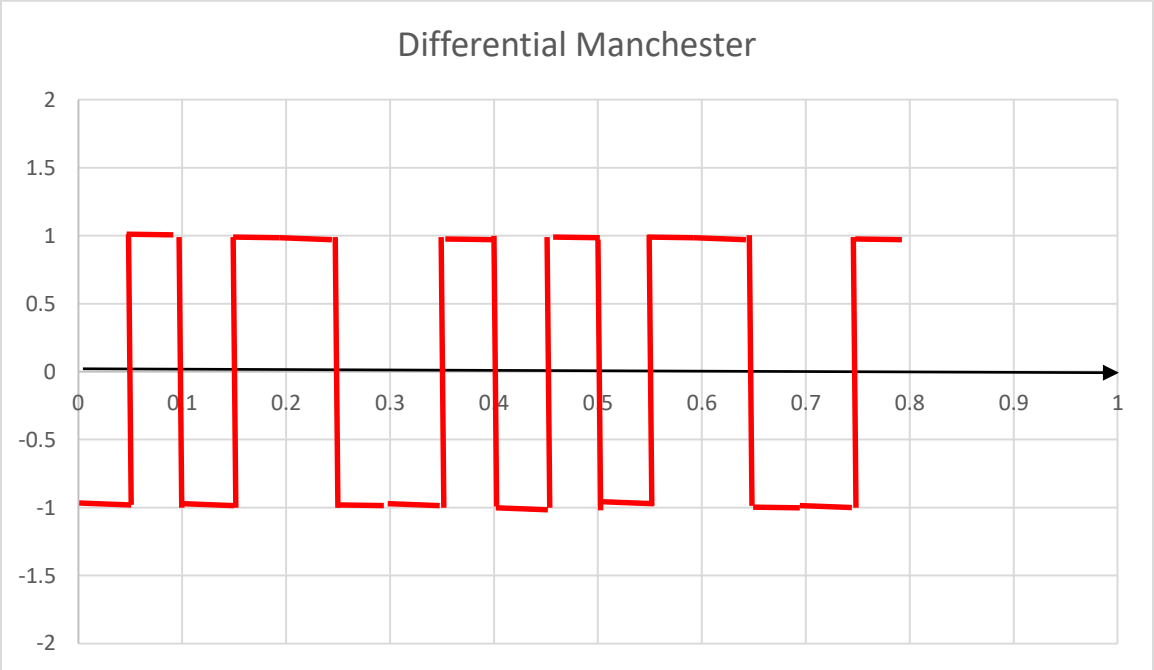
11111111



01010101



00110011



The average number of changes = $\frac{16+8+12+12}{4} = 12$

Since, each sequence has 8 data elements which means the data rate (N) = 8.

Thus, the Band width (B) = $\frac{12}{8}$

Q.3

What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four levels of digital signaling?

Bandwidth = 200 KHz

L = 4

The maximum date rate of channel $N = 2 * B * \log_2 L$

$N = 2 * 200 * \log_2 4$

$N = 800\ kbps$

Q.4

We want to transmit 1000 characters with each character encoded as 8 bits.

a. Find the number of transmitted bits for synchronous transmission.

1,000 * 8 = 8,000 bits

b. Find the number of transmitted bits for asynchronous transmission.

Since each character is represented by (8 + 2) bits

1,000 * 10 = 10,000 bits

c. Find the redundancy percent in each case.

Synchronous:

Each character is represented by 8 bits, and the whole bits are used to represent 1000 characters. Thus, the redundancy percent is 0%

Asynchronous:

Each character is represented by 10 bits, that means there are 2000 extra bits. Thus, the redundancy percent is 25%

Q.5

We have a baseband channel with a 1-MHz bandwidth. What is the data rate for this channel if we use each of the following line coding schemes?

a. NRZ-L

$N = 2 * 1 = 2Mbps$

b. Manchester

$N = 1 * 1 = 1Mbps$

c. MLT-3

$N = 1 * 3 = 3Mbps$

d. 2B1Q

$N = 1 * 4 = 4Mbps$

Q.6

What are the differences between serial and parallel transmission?

Serial transmission:

We need just one communication channel to transmit data between two devices because the bit follows the other bits, because of that the serial transmission is reducing the cost of transmission more than parallel transmission by roughly a factor of n.

Parallel transmission:

N bits of data are sent at a time instead of 1 in parallel transmission. Also, the parallel transmission is faster than the other ways that use to transmit data, and the transfer speed is increasing by factor of n over serial transmission

Q.7

What is the Nyquist sampling rate for each of the following signals?
a. A low-pass signal with bandwidth of 200 KHz?
Low-Pass signal = $200 * 10^3 Hz$
$= 200{,}000\ Hz$
Nyquist sampling rate $= 2 * f(max)$
In a low-pass signal, the minimum frequency $f(min) = 0$ and $f(max) = 200{,}000$
So,

$Nyquist = 2 * 200{,}000$
$= 400{,}000$

b. A band-pass signal with bandwidth of 200 KHz if the lowest frequency is 100 KHz?

$Bandwidth = 200KHz$

$f(min) = 100KHz$

$The\ maximum\ frequency = B + f(min)$

$f(max) = 200 + 100 = 300KHz$

$Nyquist = 2 * f(max)$

$= 2 * 300{,}000$

$= 600{,}000$

Q.8

In a digital transmission, the sender clock is 0.2 percent faster than the receiver clock. How many extra bits per second does the sender send if the data rate is 1 Mbps?

$$Extra\ bits = \frac{0.2}{100} * 1 * 10^6$$

$= 2{,}000\ bits$

Q,9

The input stream to a 4B/5B block encoder is

0100 0000 0000 0000 0000 0001

Answer the following questions:

a. What is the output stream?
0101 11110 11110 11110 11110 01001

b. What is the length of the longest consecutive sequence of 0s in the input?
21

c. What is the length of the longest consecutive sequence of 0s in the output?
2

Q.10

Distinguish between data rate and signal rate.

The data rate is known as the number of data elements or bits that are sent in 1 sec, and it is measured by bits per second (bps). It is also known as bit rate.

The signal rate is defined as the number of signal elements which is sent in 1 sec, and it is measured by baud. It is also known as baud rate or modulation rate.