(1)

ID : 13748

Name : Hamza Ishaq

Computer Communication Network

Q1 (1)

Solution

Data rate = 100 Kbps

a. Frequency = 0 KHz $\Rightarrow P = 1$

b. Frequency = 50 KHz

$P = 50\,KHz \div 100\,Kbps$

$= 0.5 \times 10^{-3}$

c. Frequency = 100 KHz

$P = 100\,KHz \div 100\,Kbps$

$= \underline{1}$.

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Computer Communication Network

Q1 3

Part a

Solution

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

$f_{max} = 0 + 200 = 200\ KHz \rightarrow f_s = 2 \times 200{,}000 = 400{,}000\ samples/s$

The number of bits per sample and the bit rate are

$n_b = \log_2 1024 = 10\ bits/sample \quad N = 400\ KHz \times 10 = 4\ Mbps$

Part (b)

The value of $n_b = 10$. We can easily calculate the value of SNR_{dB}

$$SNR_{dB} = 6.02 \times n_b + 1.76 = 61.96$$

Part (c)

The value of $n_b = 10$.

The minimum bandwith can be calculated as

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

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Computer Communication Network

Q1 (a) (4)

Solution :

Here, bandwidth = 200 KHz = 200000 Hz

∴ The maximum data rate can be calculated as

$$N_{max} = 2 \times B \times n_b$$

$$= 2 \times 200000 \times \log_2 4$$

$$= 8 \times 10^8 \text{ bps}$$

$$= 800 \text{ Kbps}$$

Q1 2.

Part (a)

Solution

$$F_s = 2 \times F_m = 2 \times 200$$

$$= 400 \text{ K samples/sec}$$

Part (b)

Solution

$$f_{max} = 100 + 200 = 300 \text{ KHz} \rightarrow F_s = 2 \times 300{,}000$$

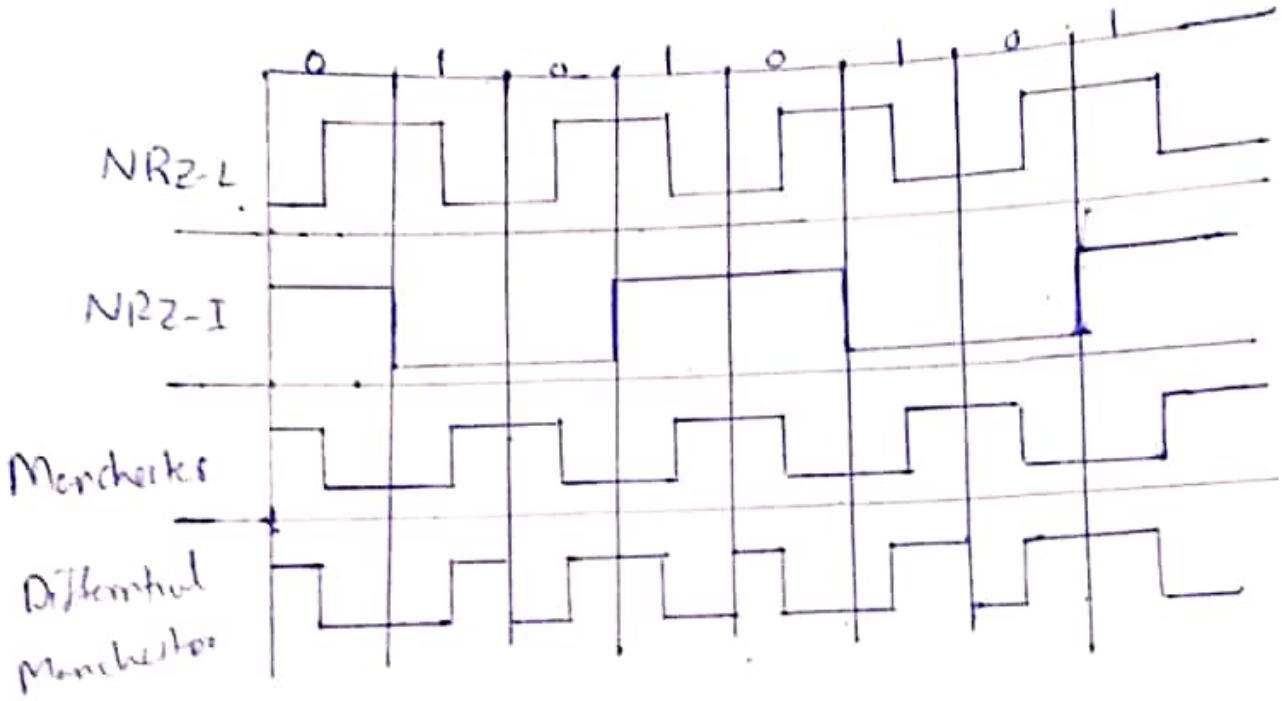
$$= 600000 \text{ samples/sec}$$

(4) ID: 13748

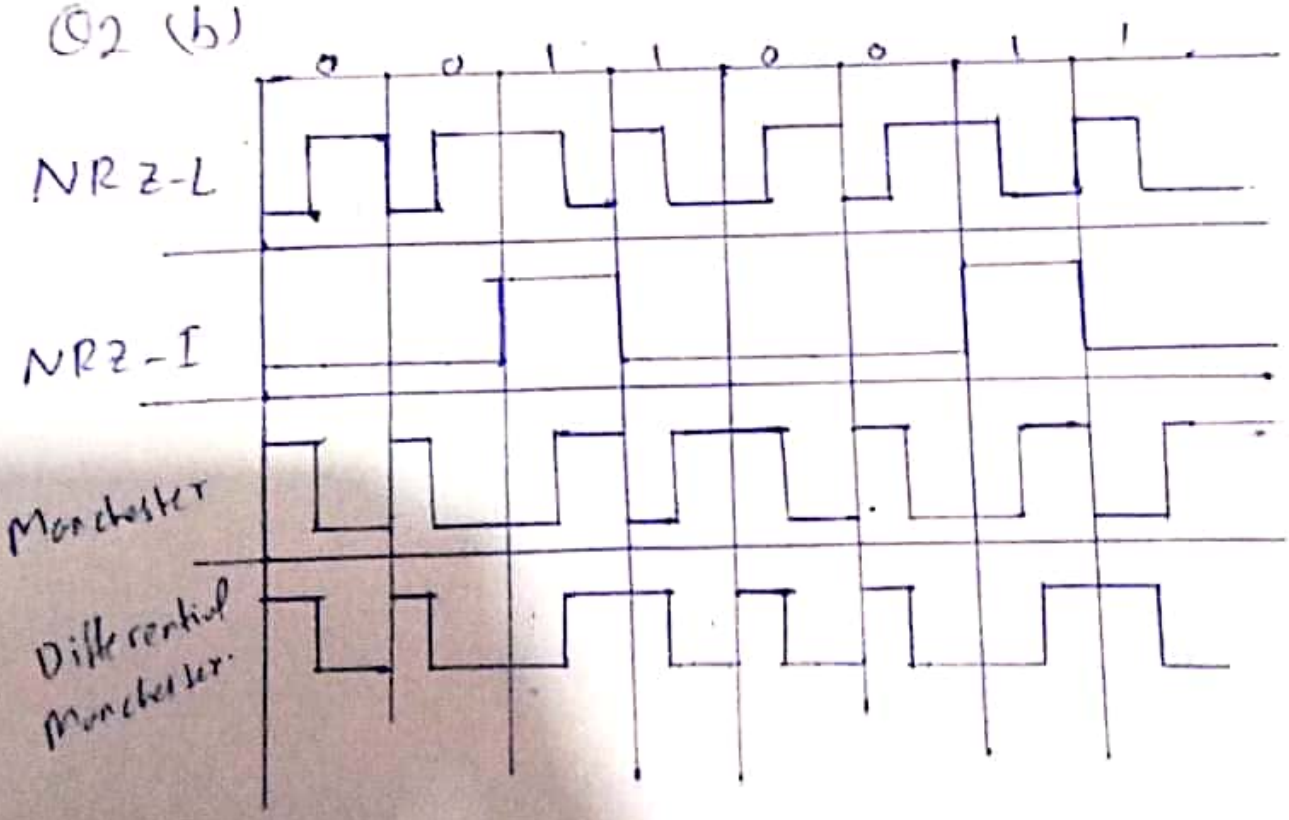
Name Hamza Tiheq

Computer Communication Network

Q2 (a)



Q2 (b)



(5) ID : 13748
Name : Hamza Ishaq
Computer Communication Network

Q3a 1

Solution

BW = 6 MHz

1) BW from 0 Hz to Fist harmonic = 6 MHz;
Bit rate = 2* fist harmonic = 2 x 6 = 12Mbps

2) BW from 0 Hz to f_{3rd} harmonic = 6 MHz;

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

f_{1st} harmonic = 6MHz/3 = 2 MHz

Bit rate = 2 x 1st harmonic
= 2 x 2 = 4 Mbps

3) BW from 0 Hz to f_{5th} harmonic = 6Mbps

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

Bit rate = 2 x f 1st harmonic = 2 x 1.2
= 2.4 Mbps.

(6) ID : 13748

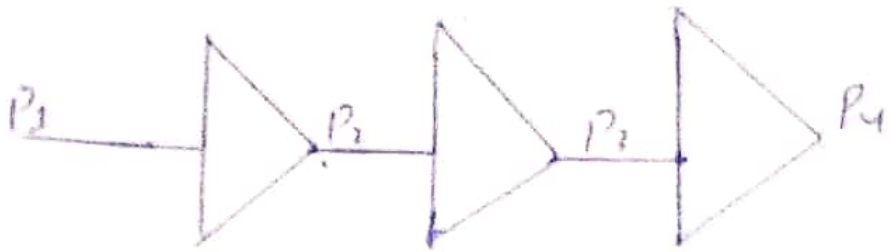
Name . Hompa Tshaq

Computer Communication Network

Q3a 2

Solution

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



For Power gain of the first stage

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

$$\frac{P_2}{P_1} = \left(10^{\left(\frac{4}{10}\right)}\right) = 2.512$$

For Power gain of three stages

$$2.512 \times 2.512 \times 2.512 = 18.851$$

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ID : 13746

Name : Hamze Ishaq

Computer Communication Network

Q3(a) 3.

Solution

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

$$\log_{10} \frac{P_2}{5} = 1$$

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

$$P_2 = 0.5\,w$$

Q3(a) 4.

Given:

bandwith 5000 bps, Frame 100,000 bit

$$\frac{100000\,b}{5000\,bps} = 20\ sec$$

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ID : 13748
Name : Hamza Ishaq
Computer Communication Network

Q3(b)

Solution:

Pulse duration = 2ms

level = 8

$$\text{Pulse rate} = \frac{1}{2\times10^{-3}} = 500 \text{ pulse/sec}$$

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

So

$$\text{Bit rate} = 500 \times \log_2 8$$

$$= 500 \times 3$$

Bit rate = 1500 bps.