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Question#1

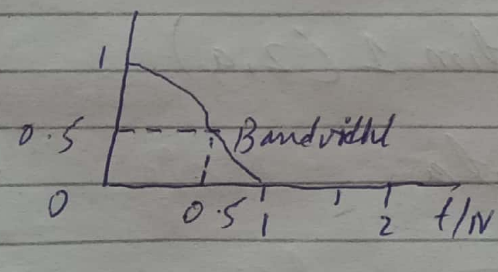
(a) (1)

Data Rate N= 100 Kbps

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

f= frequency
N= data rate
P= energy per Hz

The given figure is



Case 1: $f = 0\ Hz$ then $f/N = 0/100 = 0$

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

Case 2: $f = 50\ KHz$ then $f/N = 5/10$
$= 0.5$

$f/N = 0.5$ so $P = 2$

(2)

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Case 2

$f = 50 Hz$

then

$f/N = 50/100 = 0.5$

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

Case 3 : $f = 100 KHz$

then

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

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

Question 1 (2, a)

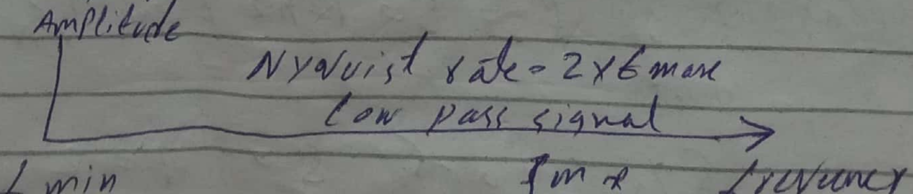
Given data

Low pass signal $(B) = 200 KHz$

$= 200 \times 10^3 Hz$

$= 200000 Hz$

Nyquist Rate



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In low pass signal

$f_{min} = 0$

Therefore Nyquist rate $= 2 \times f_{max}$

$= 2 \times 200000$

$= 400000$ sample/s.

(b)

Given data

In a band pass signal

f_{min} = bandwidth plus minimum frequency

$f_{max} = 200 + 100$

$= 300 KHz$

$= 300 \times 10^3 Hz$

$= 300000 Hz$

Therefore Nyquist rate $= 2 \times f_{max}$

$= 2 \times 300000$

$= 600000$ sample/s.

Question#1 (3,a)

(a)

Bit rate = sampling rate × Number of bits per simple

$= f_s \times n_b$

$n_b = \log 1024 = 10$ bits.

$f_s = 2 \times 200 KHz = 400 KHz$

Bit rate $= f_s \times n_b$

$= 400 \times 10$

$= 4$ Mbps

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(3,b)

(b)

$SNR_{db} = 6.02 n_b + 1.76 dB$

$= (6.02 \times 10) + 1.76$

$= 60.2 + 1.76$

$\boxed{SNR = 61.96}$

(3, c)

(c)

$B_{min} = n_b \times B_{analog}$

B_{analog} represents the bandwidth of analog signal

$B_{min} = \underline{10 \times 200 \, KHz}$

$= 2000 \, KHz.$

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(4)

Bandwidth = 200 KHz

= 200000 Hz

∴ The maximum data rate can be calculated

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

$= 2 \times 200000 \times \log_2 4 = 8 \times 10^8 \, bps$

$= 800 \, Kbps.$

Question #2

We need to draw the graph for

a) 01010101
b) 00110011

NRZ-L, NRZ-I, manchester, B-Ami and we find bandwith

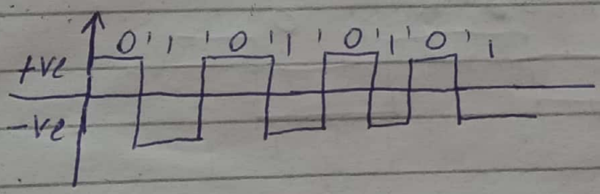
NRZ-L

In NRZ-L the voltage level are both sides of time axis

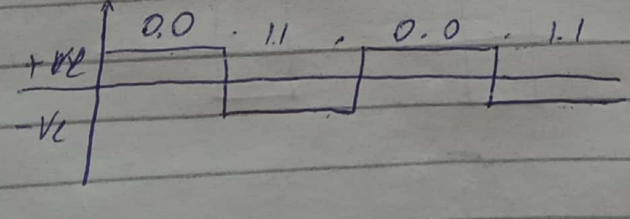
Voltage level +ve = 0
" " -ve = 1

Graph for 01010101

(a)



For 00110011



NRZ-L has an average singal, note is = N/2 means average number of Changes in signal level

The minimum bandwidth for average rate is

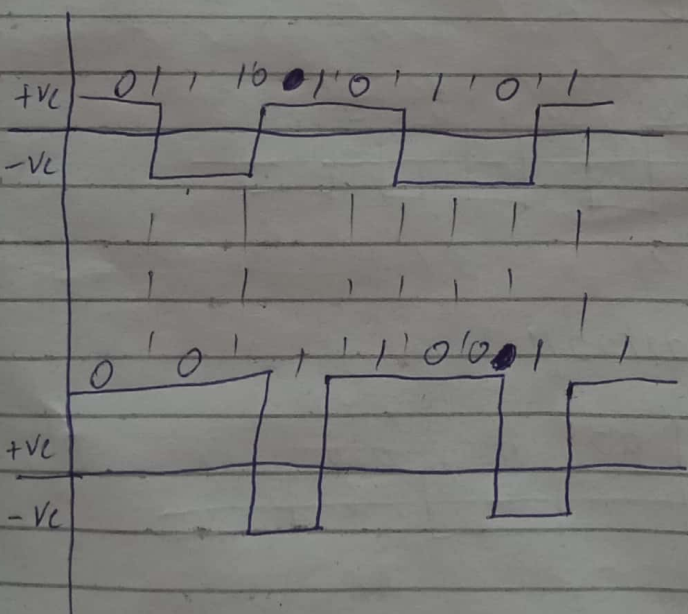
$B_{min} = S = N/2$ N-2 bitrate

$B_{min} = N/2$

NRZ-I

This is same as NRZ-L but inversion occurs when next bit is 1 otherwise no inversion.

NRZ-I



Average signal rate of NRZ-I is

$= N/2$

$B_{min} = N/2$

Q No#3

① Given data

Tv Channel bandwidth (B) = 6MHz
Using first harmonic

$$(B) = \frac{\text{data rate (bit rate)}}{2}$$

Data rate = 2 × B
= 2 × 6

Datarate = 12 Mbps

Using first and three harmonics a better result can be achieved.

$$(B) = 3 \times \frac{\text{data rate}}{2}$$

$$\text{Data rate} = \frac{2 \times B}{3}$$

$$= \frac{2 \times 6}{3}$$

= 4 Mbps

~~(B) = 6×~~

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Using 1st and 5th harmonic

$$(B) = \frac{5 \times \text{bitrate}}{2}$$

$$= \frac{2 \times B}{5}$$

$$= \frac{2 \times 6}{5}$$

data rate = 2.4 Mbps

Part (2)

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

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

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

$$= 10(-0.046)$$ since

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

Attention (dB) = 0.46 dB

Part (3)

Given

$P_s = 5W$

Attention = $-10db$

Therefore

$-10 = 10\log_{10}(Pdk)$

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

$Pd = 0.5W$

Part (4)

Total gain (Pdb) = $3 \times 4dB$

$Pdb = 12dB$

The signal is amplified than

$Pdb = 10\log_{10}^{9}$

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

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

$P = 12$

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Part (5)

Bandwidth = 5Kbps

= 5000 bps

(1 Kbps = 1000Kbps)

it takes time to send a frame of 100,000 bits out of this device

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

$$\boxed{T = 20s}$$

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Part (6)

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

8 min = 8 × 60 s

= 480 s.

Convert miles per second to Km/s

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

= 300000 Km/s

Therefore the distance b/w sun and earth is

= 480 × 300000

= 144,000,000 Km/s.

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QNo# 3 (b)

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

Bit rate = Pulse rate × $\log_2 L$

= $500 \times \log_2 8$

= **1500**

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