CSE-320

LAB - Assignment-3

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Answer to the qn. 1

Line coding is the process of connecting digital data to digital signals. We assume data in the form text form as well as numbers, graphical, images, audio or video. are stored in computer memory. As sequence of bits, line coding converts a sequence of bits to a digital signal.

Characteristic of line coding:

① Signal Element vs Data element:

Data elements are what we need to send. signal elements are what we can send. Data elements are being carried, signal elements are the carriers.

2) Data Rate vs Signal rate: The data rate defines the number of data elements (bits) sent in 1's. The signal rate defines the number of signal elements sent 1 sec. Sometimes the data rate is called bit rate & signal rate is called pulse rate.

3) Bandwidth: Digital signal that carries information is non periodic. Bandwidth of a non periodic signal is continuous with an infinite range. However, most digital signals are encounter in real life have a bandwidth with finite values.

4) Baseline wandering: In decoding a digital signal the receiver calculates a running average of the received signal power. This average is called baseline. The incoming signal power is evaluated against this baseline to determine the value of the data element.

5) DC components: When the voltage level in a digital signal is constant for a while, the spectrum creates very low frequencies. These frequencies around zero, called DC components

6) Self-synchronization: To correctly interpret the signals received from the sender, the receiver bit intervals must correspond exactly to the sender bit intervals.

7) Built in Error detection: It is desirable to have a built in error detecting capability in the generated code to detect some of or all the errors that accured transmission.

8) Immunity to noise and Interface:

Another desirable code characteristic is a code that is immune to noise and other interfaces.

9) Complexity: A complex system is more costly to implement than a simple one. For instance, a scheme that uses four signal level is more difficult to interpret than one that uses only two levels.

Answer to qn. - 2

PCM (pulse cod modulation) : It is defined as a digital technique that involves sampling an analog signal at regular intervals and coding the measured amplitude into a series of binary values which are transmitted by modulation of a pulsed, or intermittent, carrier.

A PCM encoder have 3 process.

① Sampling : is done where the analog input signal is sampled at regular intervals. The sampling of the signal is done at the rate off

2) Quantization: It rounds off each sample to the nearest discrete level. This performs the approximation of each sample thus assigning it a particular discrete level.

3) Encoding: is done by conversion of the quantized signal into binary codes.

Answer to the q.n. 3

Here, $N = 100 \times 1000$

$= 100000$ [1kbps = 1000 bps]

$n = 1$

We assume that the average value of C is $\frac{1}{2}$

The bare rate is,

$$S = C \times N \times \frac{1}{n}$$

$$= \frac{1}{2} \times 100000 \times 1$$

$$= 50,000$$

$= 50$ kbound.

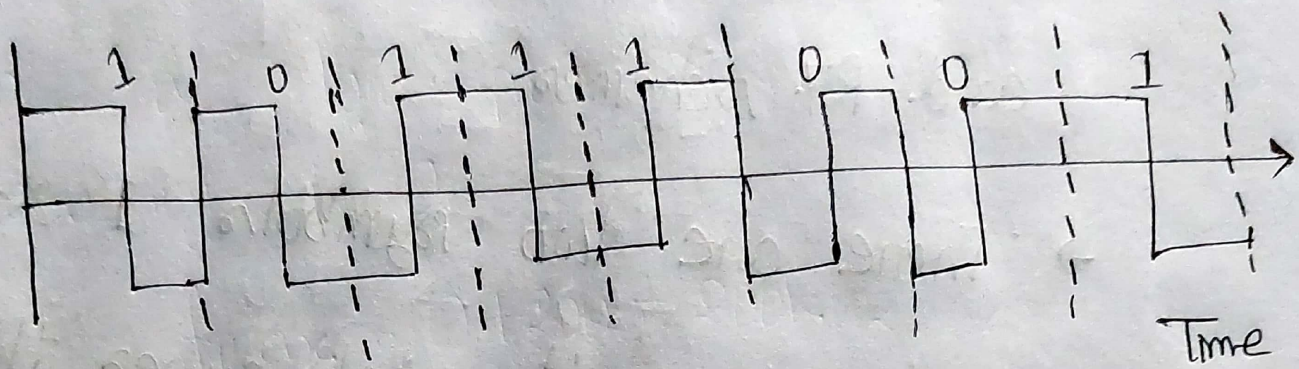
Answer to q.n. 4

Self synchronizing digital signal includes timing information in the data being transmitted. To correctly interpret the signals received from the sender. the receiver's bit intervals must correspond exactly the senders bit intervals. Self synchronizing is a uniqve decodable in which the symbol stream form by a portion of any two adjecent codewords

Due to the lack of synchronization cause huge impact decoding and this is

know as deadlock situations. Dead lock is a situation where a set of processes are blocked because each process is holding a resource.

Answer to q.n.-5



Differential Manchester Encoding represents a line code in digital frequency modulation in which data and clock signals are combined.

Here, 0 represented as ⊓⌊ or ⌊⊓

& 1 represented as ⌊ or ⊓

So, data stream is 10111001

In brief explain,

→ D. Manchester combines NRZ-I [Non return to zero] and RZ schemes.

→ There are two symbols '1' & '0'

→ Only one symbol causes the level change.

→ We make inversion only for '1', & for '0' there is no inversion

→ It is a line code in digital frequency modulation and so it doesn't require block coding.

Answer to q.n-6

(a)

Non Return to Zero is basically a binary code that is used in telecommunication transmission where the data bit 1 is of positive voltage and 0 data bit is of negative voltage.

NRZ-I basically have long series of 0's or 1's resulting in clock recovery difficulties. This uses a transition in the middle of the clock cycle. But this actually occurs when only 1 occurs

NRZ-L: here the level of voltage determines the value of the bit typically binary 1 maps to logic level high and the binary 0 maps

to logic level low.

NRZ-I is better than NRZ-L. For instance, Lets consider a situation where two data wires are wrongly connected in each others place. So, in NRZ-L all the bits gets reversed since the voltage levels gets swapped whereas in NRZ-I all the bits are recognized by transition. So that all the bits will be correctly interpreted.

Answer to q.n 7

Discussing about the advantages and disadvantages of Biphase.

Advantages:

1) Since they are bipolar signals, ideally no DC components need to be present.

2) It provides features for error detection, this is done by detecting absence of expected transitions.

3) It also provides a guarenteed mid bit transitions whereby offering synchronization facility at the reciever side. These are actually called the self clocking codes.

Disadvantages:

1) Biphase is basically used in shorter distance especially in LAN's.
2) It maps at least one transition per bit time and probably 2 bits
3) Its modulation or signal rate is double that of non-return to zero (NRZ). Therefore higher bandwidth is required for biphase signals.

Answer to q.n.- 8

(a)

In a low-pass signal, the minimum frequency is 0.

$$f_{max} = 0 + 200 = 200\,KHz.$$

Nyquist rate $f_s = 2 \times 200000$

$= 400000$ samples/s

(b)

In a bandpass signal,

The bandwidth = 200 kHz

Lowest frequency = 100 kHz

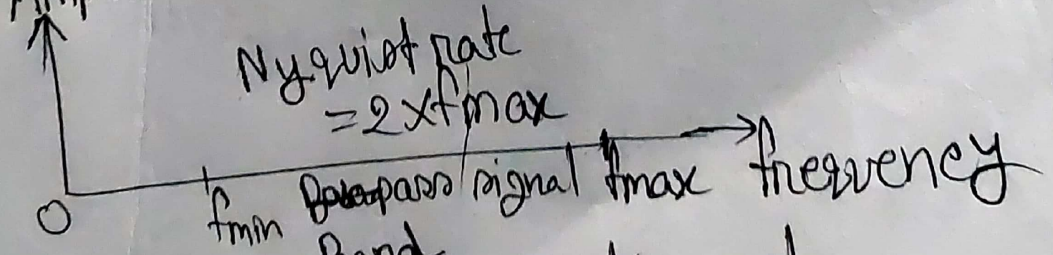


Fig: Nyquist sampling rate

Here, ~~fmin = fmax~~ [In bandpass signal]

$f_{max} = f_{min} + Bandwidth$

$= 200 + 100$

$= 300 kHz$

$= 300000 Hz$

So

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

$= 2 \times 300000$

$= 600000$ samples/s

Answer to q.n. 9

Let, n = No. of bits

$n = 4$ [Given]

step size, $\Delta = \frac{40 - (-40)}{2^4} = 5$

Thus the step size is 5 so, there should be an increment of 5 in amplitude level.

The ~~codeword~~ codeword corresponding to each quantized values are:

Quantized value — codeword

−40	↔	0000
−35	↔	0001
−30	↔	0010
−25	↔	0011
−20	↔	0100
−15	↔	0101
−10	↔	0110
−5	↔	0111
0	↔	1000
5	↔	1001
10	↔	1010
15	↔	1011
20	↔	1100
25	↔	1101
30	↔	1110
35	↔	1111

Time	Analog signal value (V)	Sampled value	Quantized value	Quantization error	Code word
0	23.7	24	25	-1	1101
1	-15.7	-16	-15	-1	0101
2	-29.6	-30	-30	0	0010
3	20.5	20	20	0	0100
4	33.5	33	35	-2	1111

The line coding using Bipolar AMI