Data Communication and Networks
BS-SE (13)

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Question 1 (a) : Assume that a voice channel occupies a bandwidth of 4 kHz. We need to multiplex 10 voice channels with guard bands of 500 Hz using FDM. Calculate the required bandwidth.

Answer:

Multiplex voice channels = 10
Need 9 guard bands,
B= Required bandwidth

B = (4 KHz) × 10 + (500 Hz) × 9
B = 44.5 KHz

Question 1 (b) : An analog signal carries 4 bits per signal element. If 3000 signal elements are sent per second, find the bit rate.

Answer:

Given: r = 4
S = 3000
N = ?
S=N*1/r
N= S*r
N= 3000*4
N = 12,000 bps

Question 1 (c) : Distinguish between a signal element and a data element.

Answer:

Signal Element: A signal element is the shortest unit of a digital signal.

- Signal elements are what we can send.
- Signal elements are the carrier.

Data Element: A data element is the smallest entity that can represent a piece of information.

- data elements are what we need to send.
- Data elements are being carried.

Question 1 (d) : Distinguish between a link and a channel in multiplexing
Answer: In a multiplexed system n-lines share bandwidth of one link. that means links refer to the physical path and channel refers to the portion of a link that carries a transmission between a group pair of lines.

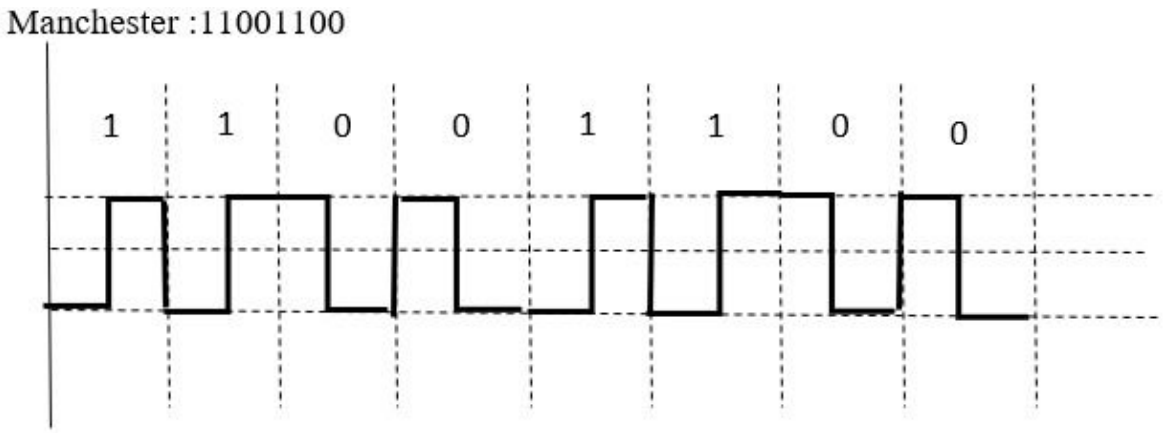
Question 1 (e) : List three different techniques in serial transmission and explain the differences.
Answer: Three different techniques in serial transmission are: Synchronous, asynchronous and isochronous

Synchronous: Data depends on external signal . This external signal controls flow of data.
Asynchronous: Data transfer does not depend on any other external quantity. It is self dependent.
Isochronous: This is a combination of Synchronous and asynchronous .

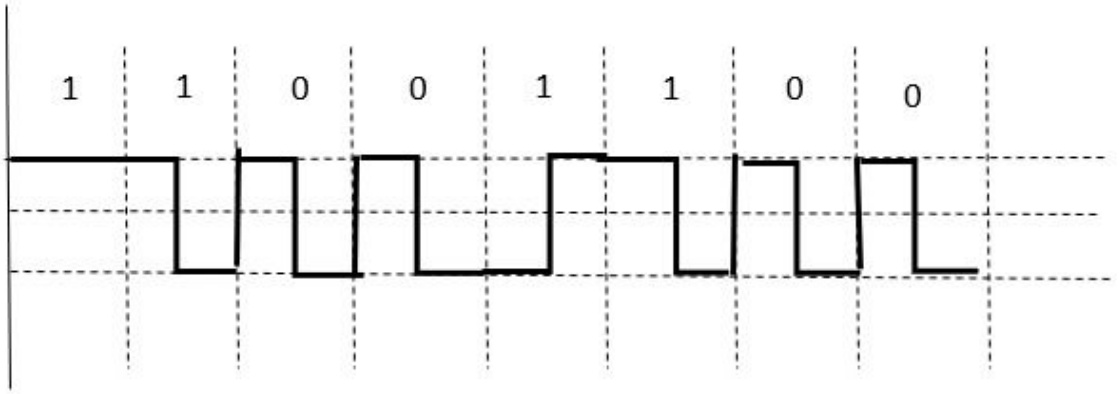
Question 2 (a) : Find the 8-bit data stream for the following case:
Answer:
Differential Manchester = 110001000

Question 2 (b) : Draw the graphs of the Manchester, differential Manchester, NRZ-I and NRZ-L schemes for each of the following data streams
Answer:

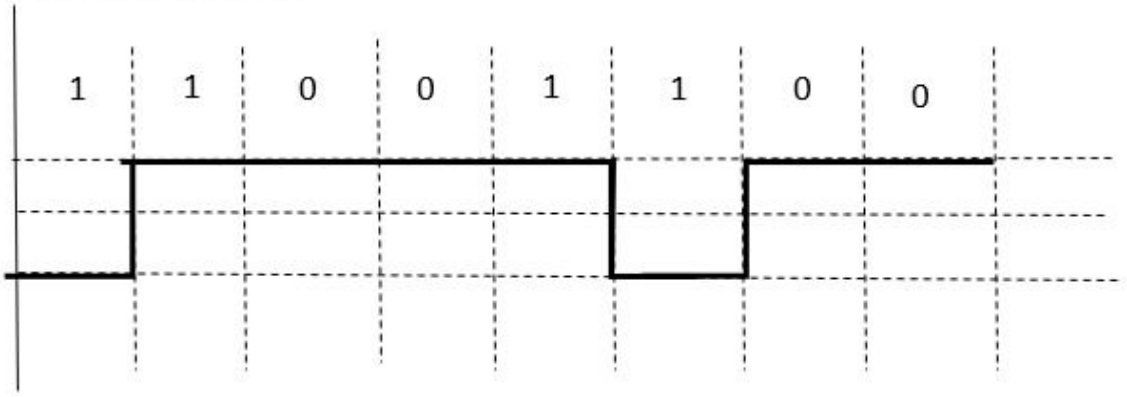
1. **11001100**



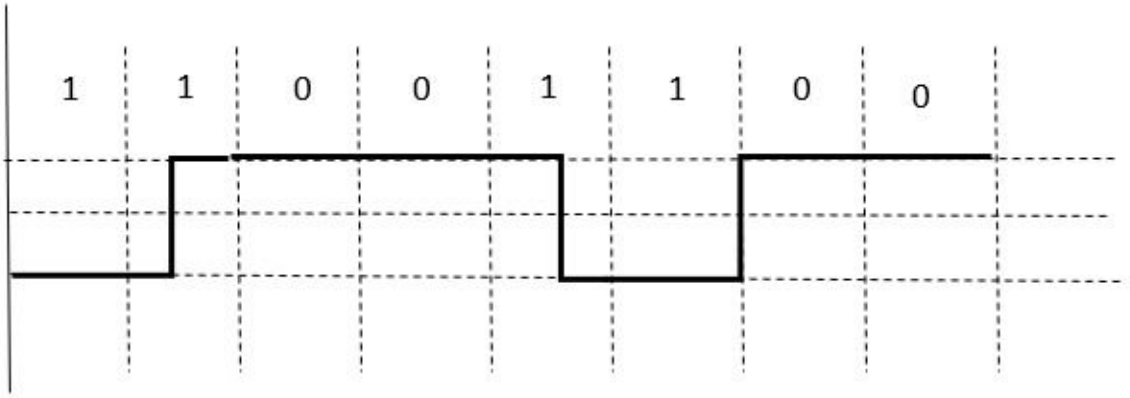
D-Manchester:11001100



NRZ-I:11001100

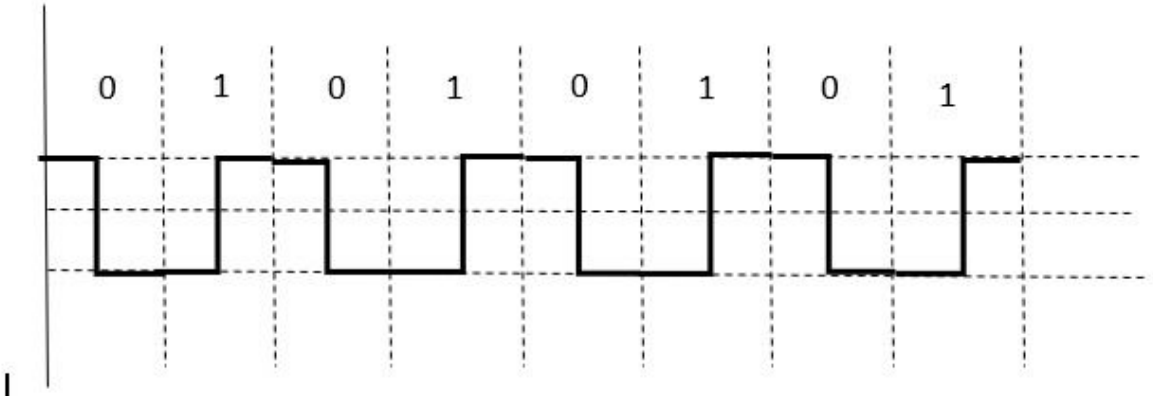


NRZ-L:11001100

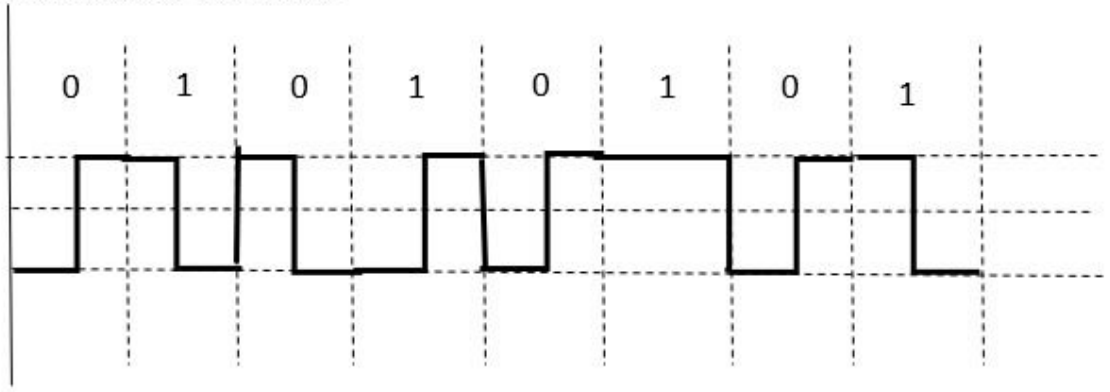


2. 01010101

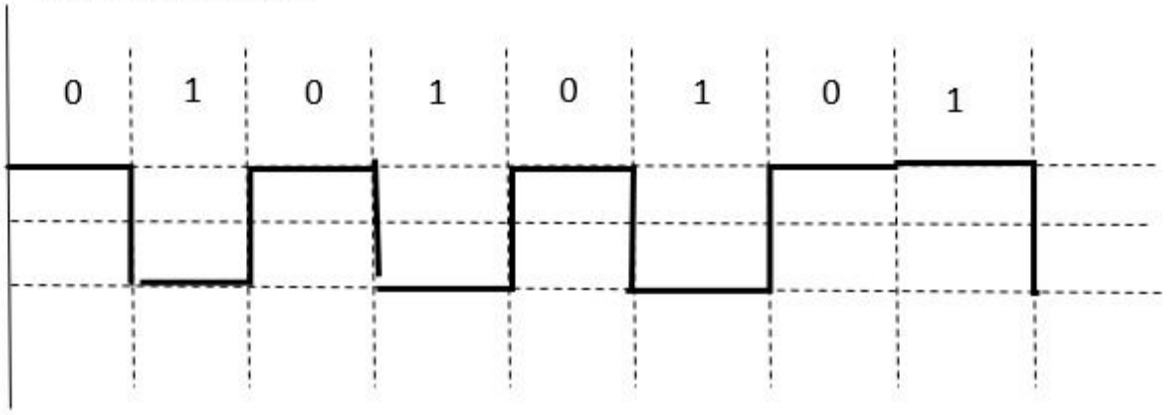
Manchester : 01010101

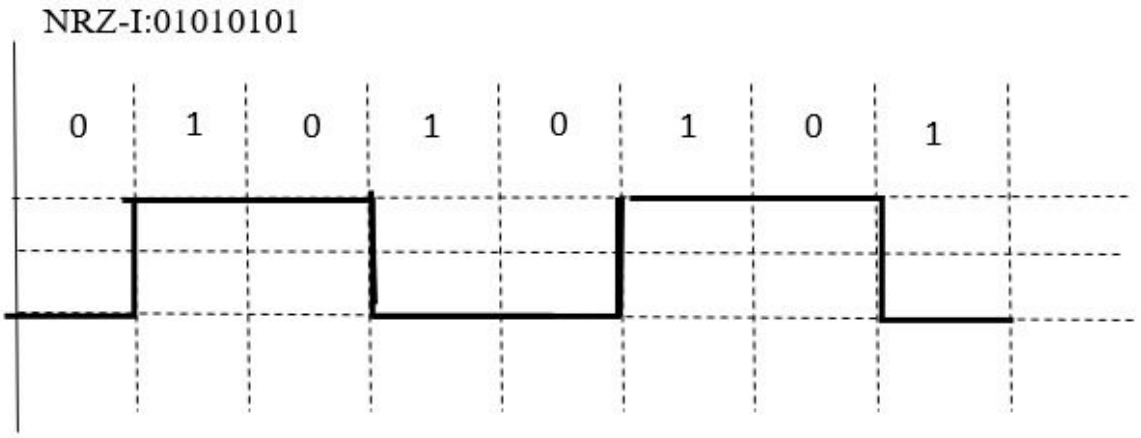


D-Manchester: 01010101



NRZ-L:01010101





Question 2 (c) : What is the Nyquist sampling rate for the band-pass signal with bandwidth of 950 KHz if the lowest frequency is 450 KHz?

Answer:

F_c = 950 KHz - 450 KHz

F_c = 500 KHz

Question 3 (a) : We have an available bandwidth of 300 kHz which spans from 500 to 800 kHz. What are the carrier frequency and the bit rate if we modulated our data by using ASK with d = 1?

Answer:

Formula: B = (1+d) x S

Middle of bandwidth: 650 KHz

d= 1

r= 1

B = (1+d) * S

B = (1+1) * NX (1/r)

300 KHz = 2*Nx(1/1)

N= 300KHz/2

N = 150 Kbps

Question 3 (b) : Which shift keying technique is used in the following diagram? Briefly explain

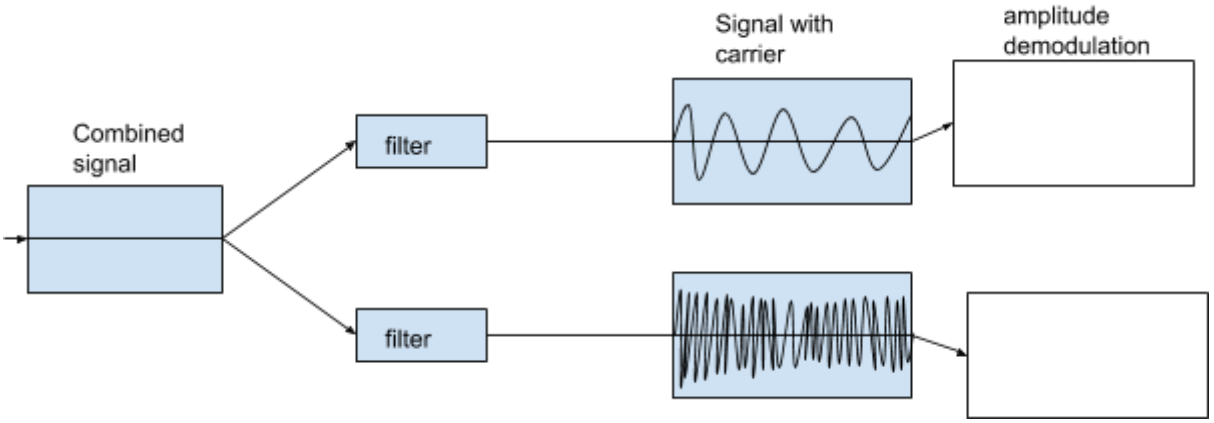
Answer: The Amplitude Shift Keying technique is used in the diagram.

Amplitude Shift Keying: its carried
the amplitude of the carrier signal is varied to create signal elements. both frequency and phase remain constant while the amplitude changes. Amplitude shift keying is normally implemented using only two levels; this is referred to as binary amplitude shift keying.

Question 4 (a) : Briefly explain the FDM Multiplexing and De-Multiplexing Process with the help of diagram and also differentiate between TDM and FDM?

Answer:

Frequency division multiplexing (FDM): A number of signals can be combined into a composite signal suitable for transmission over a common channel. Each signal is modulated using different carrier frequency. The signals must be kept apart so that they do not interfere with each other and thus they can be separated at the receiving end.
In the demultiplexing process we use filters to decompose the multiplexed signal into its constituent component singals.



Difference between TDM and FDM

TDM:

- Both Analog and Digital signals.
- Times scale is shared.
- synchronization pulse is necessary.
- Interference of the signal is low and negligible.
- The available channel is used effectively.
- circuitry is not that complex.
- It is not that expensive technique

FMD:

- Only Analog signals

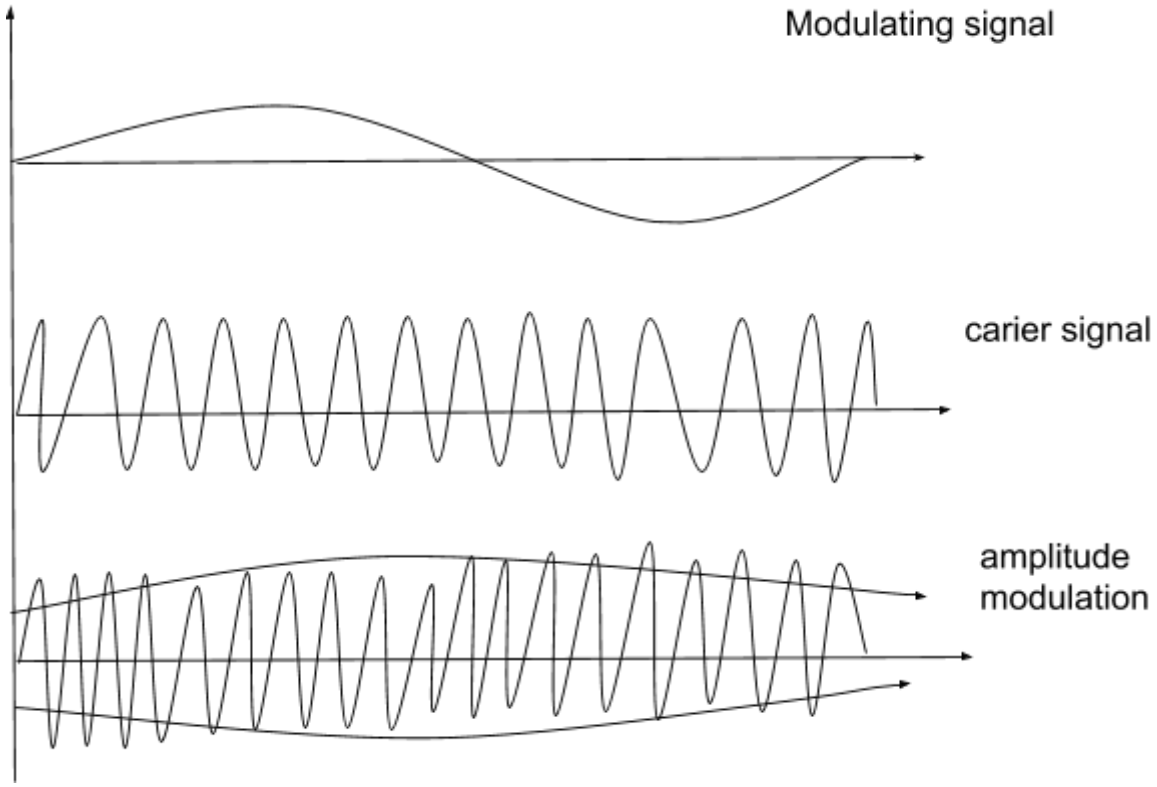
- Frequency is shared
- A guard band is necessary.
- Interference of signal is quite high.
- The available channel is used ineffectively
- Complex circuitry at the transmitter as well as receiver end.
- It is an expensive multiplexing technique

Question 4 (b) : Briefly explain Analog to Analog conversion techniques with the help of diagrams?

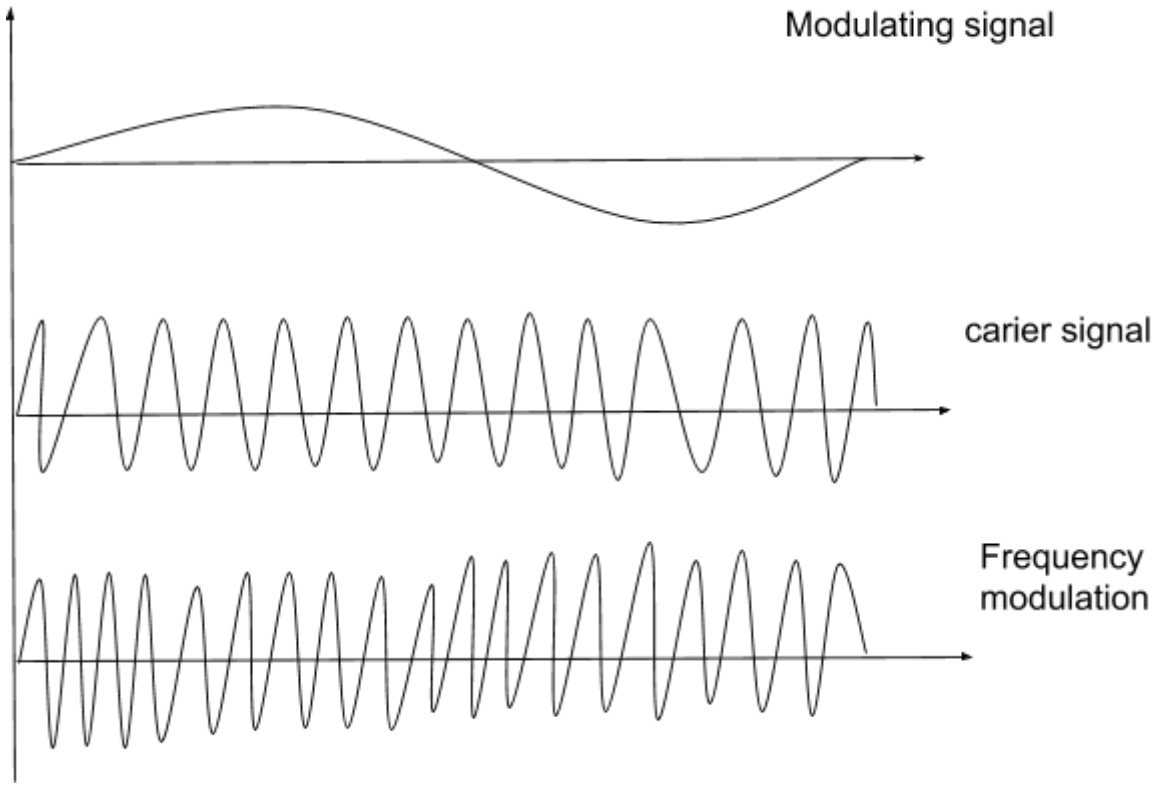
Answer: Analog to analog conversion: Analog signals are modified to represent analog data, it is also known as analog modulation. It is required when Bandpass is used.Bandpass is a range of frequencies which are transmitted through a bandpass filter which is a filter allowing specific frequencies to pass, preventing signals at unwanted frequencies.

Three types of conversions:

1. **Amplitude Modulation:** The process of changing the amplitude of a high frequency carrier wave in accordance with intensity of signal is called amplitude modulation. Amplitude of the carrier wave and the signal being modulated.



2. **FREQUENCY MODULATION:** The modulation in which the frequency of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping phase and amplitude as constant.



3. **PHASE MODULATION:** The modulation in which the phase of the carrier wave is varied according to the instantaneous amplitude of the modulating signal keeping amplitude and frequency as constant.