Department of Electrical Engineering
Assignment
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Course Details

Course Title:	**Advance Computer Networks**	**Module:**	**1**
Instructor:	**Dr. Naeem Ahmad Jan**	**Total Marks:**	**30**

Student Details

Name:	**MUHAMMAD ABOBAKAR SADIQ**	**Student ID:**	**15423**

Question No.1 (a)

Explain Physical layer services and Transmission Impairments?

Answer

Physical layer services:

According to the OSI model physical layer is the last layer. In other words from sending side the last layer which add their functionality is physical layer while in receiving side the first layer which add their functionality is physical layer shown in the diagram.

In the above diagram a physical layer provide functionality to data link layer all the data is passed from all the layers i-e (Data link layer, network layer, transport layer, session, presentation) and comes to physical layer for sending through transmission media.

- In other layers the data is in bits form while in physical layer the bits is converted into signal form.
- Physical layer actually decide how to send the data.
- Physical layer deal with hardware.
- In sending side the bits is converted into signal while in receiving side the signal is converted into bits.
- Physical layer deals with the following

I. Cables and connectors
II. Physical topology
III. Transmission mode
IV. Hardware (repeaters, hubs)
V. Multiplexing

Transmission impairments:

Signal travel through transmission media which are not perfect the imperfection causes transmission impairments.

For example

If a data is send from A to B it is not necessary that B received on which level the data is send from A and same is the case with B that causes transmission impairments.

There are three causes of transmission impairments

1. Attenuation
2. Distortion
3. Noise

1. **Attenuation:**

For the receiver to interpret the data accurately, the signal must be sufficiently strong. When the signal passes through the medium, it tends to get weaker. As it covers distance, it loses strength.

Attenuation is losses in Energy.

2. **Distortion**

Signals are sent over media with pre-defined speed and frequency. If the signal speed and frequency do not match, there are possibilities that signal reaches destination in arbitrary fashion. In digital media, this is very critical that some bits reach earlier than the previously sent ones.

3. **Noise**

Random disturbance or fluctuation in analog or digital signal is said to be Noise in signal, which may distort the actual information being carried. Noise can be characterized in one of the following class:

- **Thermal Noise**

  Heat agitates the electronic conductors of a medium which may introduce noise in the media. Up to a certain level, thermal noise is unavoidable.

- **Intermodulation**

  When multiple frequencies share a medium, their interference can cause noise in the medium. Intermodulation noise occurs if two different frequencies are sharing a medium and one of them has excessive strength or the component itself is not functioning properly, then the resultant frequency may not be delivered as expected.

- **Crosstalk**

  This sort of noise happens when a foreign signal enters into the media. This is because signal in one medium affects the signal of second medium.

- **Impulse**

  This noise is introduced because of irregular disturbances such as lightening, electricity, short-circuit, or faulty components. Digital data is mostly affected by this sort of noise.

Question no.1 (b)

Express a period of 1 ms in microseconds, and express the corresponding frequency in kilohertz and a sine wave is offset one-fourth of a cycle with respect to time zero. What is its phase in degrees and radians?

Solution

As 1 millisecond is equal to 1000 micro seconds

So, mathematically

1**ms**=1000**μs**

Or

$1ms=10^3$ μs

And frequency

As frequency is inversely proportional to time so

F=1/T which implies that F=1/1000 so F=0.001 Hz

In kilohertz

F=0.001×1000

F=1 kHz

2nd part of this question

Need phase in degree and radian?

Solution

As we know that one complete cycle is 360 degrees

Therefore,

¼ cycle is (1/4)360=90 degrees

In radians

90×2**π/**360rad=1.57 radians

Question No. 2 (a)

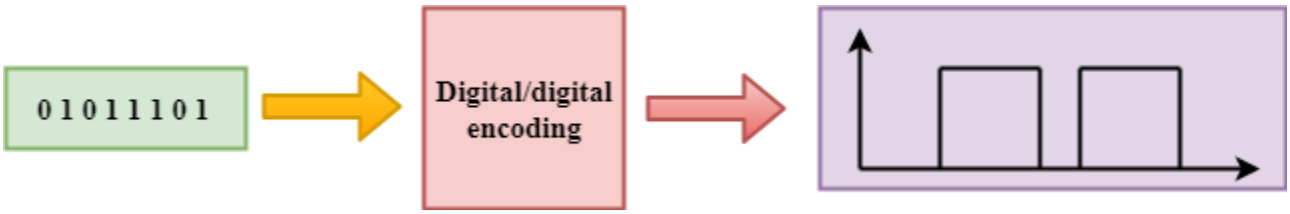
Explain the classification of digital to digital conversion? Difference between data element and signal element?

Answer

Digital to Digital Conversion:

It is the process of converting binary data, sequence of bits to a digital signal.

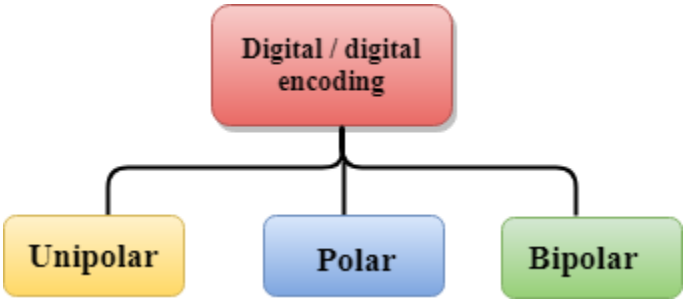
It is also called line coding.



Classification of digital to digital conversion

This is classified into three parts

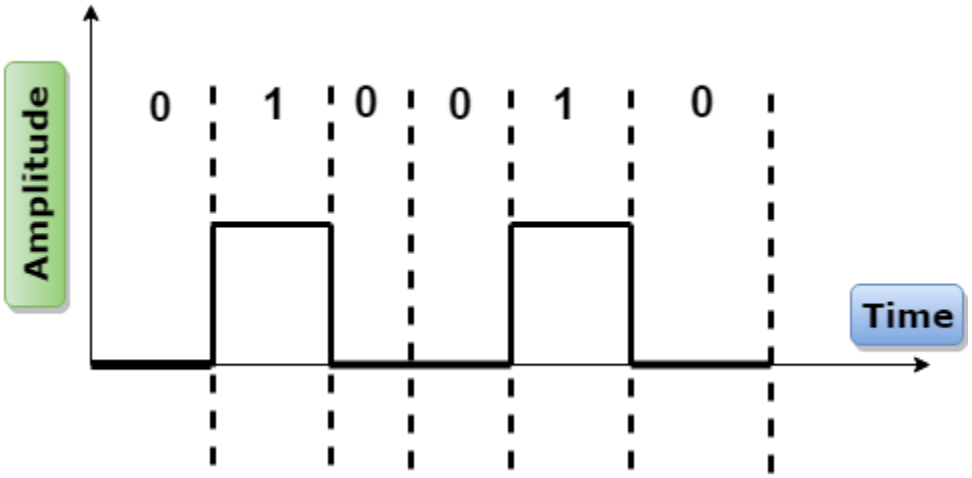
A. Unipolar
a) Return to zero unipolar
b) Non return to zero unipolar
B. Polar
a) Return to zero polar
b) Non return to zero polar
c) Manchester
C. Bipolar
a) AMI(Alternate mark inversion)



A. Unipolar

Only one voltage level other than zero

1=+ and 0=0



Non return to zero (NRZ)

It is unipolar line coding scheme in which positive voltage defines bit 1 and the zero voltage defines bit 0. Signal does not return to zero at the middle of the bit thus it is called NRZ.

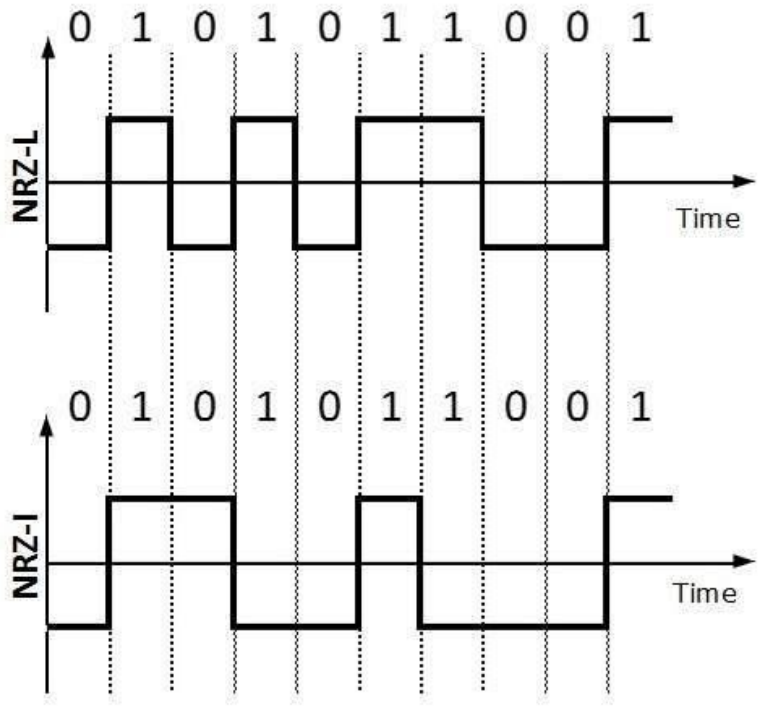
Return to zero (RZ)

Where the signal returns to zero in the middle of the bit period. With a 50% duty cycle each rectangular pulse is only at a positive voltage for half of the bit period.

B. Polar

Two voltages level other than zero

+A/2 and –A/2



NRZ Polar

- NRZ stands for Non-return zero.
- In NRZ encoding, the level of the signal can be represented either positive or negative.

RZ Polar

- RZ stands for Return to zero.
- There must be a signal change for each bit to achieve synchronization. However, to change with every bit, we need to have three values: positive, negative and zero.
- RZ is an encoding scheme that provides three values, positive voltage represents 1, the negative voltage represents 0, and zero voltage represents none.
- In the RZ scheme, halfway through each interval, the signal returns to zero.
- In RZ scheme, 1 bit is represented by positive-to-zero and 0 bit is represented by negative-to-zero.

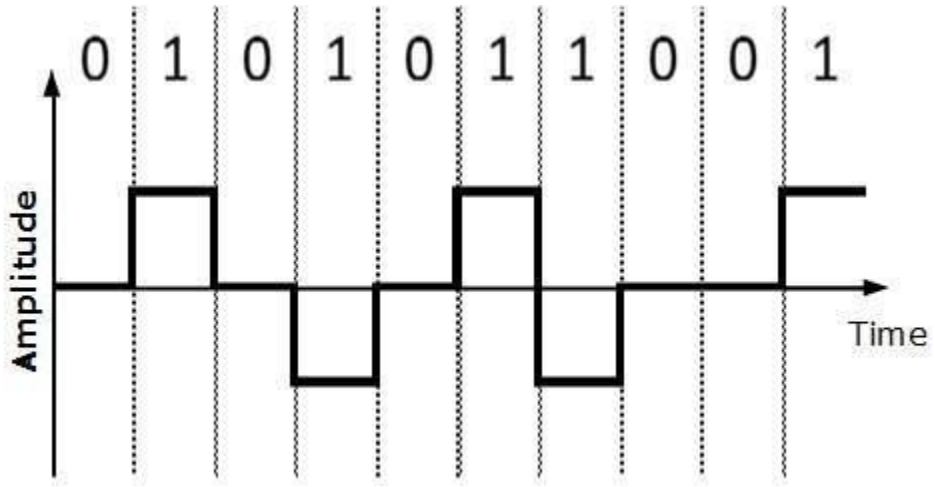
Manchester

- It changes the signal at the middle of the bit interval but does not return to zero for synchronization.
- In Manchester encoding, a negative-to-positive transition represents binary 1, and positive-to-negative transition represents 0.
- Manchester has the same level of synchronization as RZ scheme except that it has two levels of amplitude.

C. Bipolar

Three voltages levels

Positive negative and zero



AMI

- AMI stands for alternate mark inversion where mark work comes from telegraphy which means 1. So, it can be redefined as alternate 1 inversion.
- In Bipolar AMI encoding scheme, 0 bit is represented by zero level and 1 bit is represented by alternating positive and negative voltages.

Question 2 (a) 2nd part

Answer:

Data element and Signal element:

Data Element

A data element is the smallest entity that can represent a piece of information (a bit).

Signal Element

A signal element is the shortest unit of a digital signal.

Difference between Data Element and Signal Element

Data Element	Signal 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.

Question No. 2 (b)

We want to digitize the human voice. What is the bit rate, assuming 7 bits per sample?

Solution

The human voice normally contains frequencies from 0 to 4000 hertz

Sampling rate = 4000 × 2 = 8000 samples/s

Bit rate = sampling rate × number of bits per sample

Bit rate = 8000 × 7

Bit rate = 56,000 bps = 56kbps

Question no. 3(a)

Explain the responsibilities of different layers of TCP/IP in detail?

Answer:

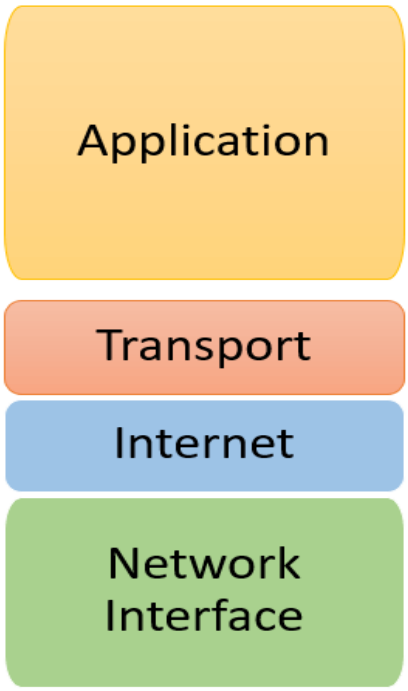
TCP/IP stands for Transmission Control Protocol/ Internet Protocol. It is specifically designed as a model to offer highly reliable and end-to-end byte stream over an unreliable internetwork.

TCP/IP Model determine how a specific computer should be connected to the internet and how data should be transmitted between them. It helps to create a virtual network when multiple computer networks are connected together. The purpose of TCP/IP model is to allow communication over large distances.

The functionality of the TCP/IP model is divided into four layers, and each includes specific protocols.

TCP/IP is a layered server architecture system in which each layer is defined according to a specific function to perform. All these four layers work collaboratively to transmit the data from one layer to another.

- Application Layer
- Transport Layer
- Internet Layer
- Network Interface



Responsibiliteies of the layers

Application layer

- Application-layer helps you to identify communication partners, determining resource availability, and synchronizing communication.
- It allows users to log on to a remote host
- This layer provides various e-mail services
- This application offers distributed database sources and access for global information about various objects and services.

Transport layer

- It divides the message received from the session layer into segments and numbers them to make a sequence.
- Transport layer makes sure that the message is delivered to the correct process on the destination machine.
- It also makes sure that the entire message arrives without any error else it should be retransmitted.

Internet layer

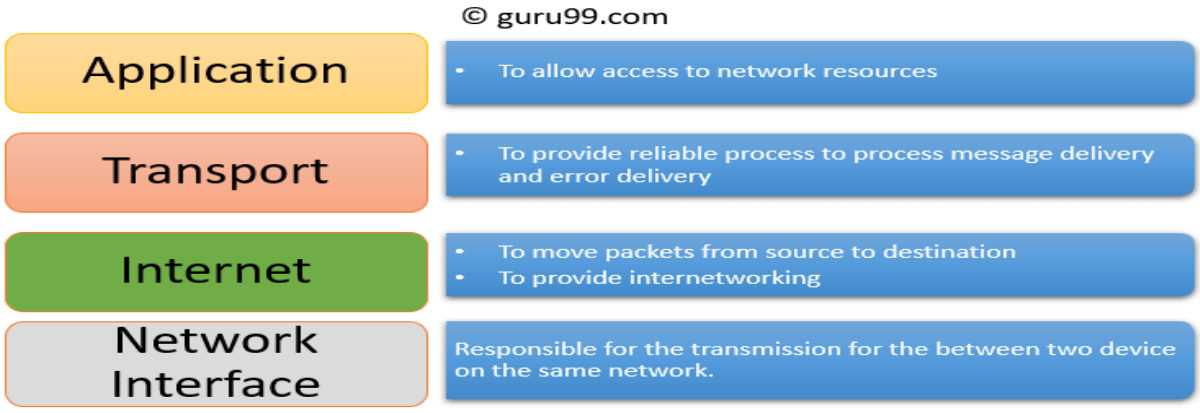
It is also known as a network layer. The main work of this layer is to send the packets from any network, and any computer still they reach the destination irrespective of the route they take.

The Internet layer offers the functional and procedural method for transferring variable length data sequences from one node to another with the help of various networks.

Network interference layer

This layer is also called a network access layer. It helps you to define details of how data should be sent using the network.

This layer defines how the data should be sent physically through the network. This layer is responsible for the transmission of the

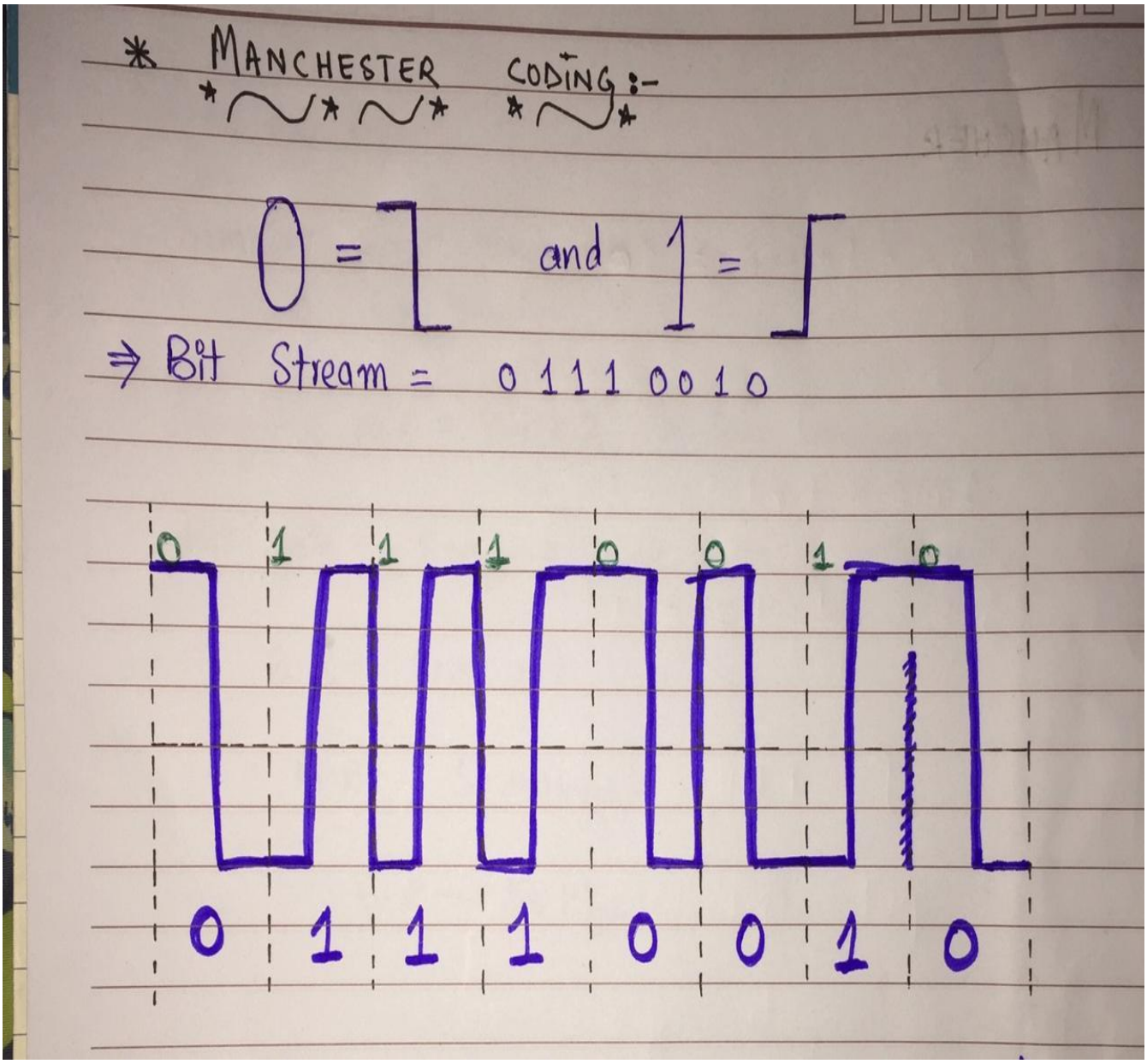


Question No. 3 (b)

Convert the following data 01110010 to Manchester coding and Bipolar AMI?

Answer

Manchester Coding:



Bipolar AMI Coding: