Department of Electrical Engineering

Assignment

Date: 20/04/2020

Course Details

Course Title:	Advance Computer Networks	**Module:**	3rd
Instructor:	Sir naeem ahmad jan	**Total Marks:**	30

Student Details

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Q1.	(a)	Explain Physical layer services and Transmission Impairments?	Marks 6
	(b)	Express a period of 1 ms in microseconds, and express the corresponding frequency in kilohertzand A sine wave is offset one-fourth of a cycle with respect to time zero. What is its phase in degrees and radians?	Marks 4
Q2.	(a)	Explain the classification of digital to digital conversion? Difference between data element and signal element?	Marks 6
	(b)	We want to digitize the human voice. What is the bit rate, assuming 7 bits per sample?	Marks 4
Q3.	(a)	Explain the responsibilities of different layers of TCP/IP in detail?	Marks 6
	(b)	Convert the following data 01110010 to Manchester coding and Bipolar AMI?	Marks 4

Ans#1 : (A)

Physical Layer :

Physical layer in the OSI model plays the role of interacting with actual hardware and signaling mechanism. Physical layer is the only layer of OSI network model which actually deals with the physical connectivity of two different stations. This layer defines the hardware equipment, cabling, wiring, frequencies, pulses used to represent binary signals etc.

Physical layer provides its services to Data-link layer. Data-link layer hands over frames to physical layer. Physical layer converts them to electrical pulses, which represent binary data.The binary data is then sent over the wired or wireless media

The physical layer is responsible for sending computer bits from one device to another along the network. It does not understand the bits; rather, its role is determining how physical connections to the network are set up and how bits are represented into predictable signals as they are transmitted either electrically, optically or via radio waves.

To do this, the physical layer performs a variety of functions, including:

- **Defining bits**: Determines how bits are converted from 0s and 1s to a signal.
- **Data rate**: Determines how fast the data flows, in bits per second.
- **Synchronization**: Ensures that sending and receiving devices are synchronized.
- **Transmission mode**: Determines the direction of transmissions and whether those are simplex (one signal is transmitted in one direction), half-duplex (data goes in both directions, but not at the same time) and full-duplex (data is transmitted in both directions, simultaneously).
- **Interface**: Determines how devices are connected to a transmission medium such as Ethernet or radio waves.

Transmission impairments :

When signals travel through the medium they tend to deteriorate. This may have many reasons as given:

- **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.

- **Dispersion**

  As signal travels through the media, it tends to spread and overlaps. The amount of dispersion depends upon the frequency used.

- **Delay 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.

- **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.

Ans#1 : (B)

1 ms = 1 *10^{-3} S

Milli second = 10^{-3} S

We can also write

Micro second = 10^{-6} S

= 10^{-3} * 10^{3} * 10^{-3} S

Kilo = 10^{3}

= 10^{3} * 10^{-6} S

= 10^{3} µs

1 ms = 10^{3} µs

As 1 ms = 10^{-3} S

As f =1 / t

so

f = 1 / 10^{-3} Hz

f = 10^{3} Hz

f= 1000 Hz

f = 1 KHz

a sin wave is offset one forth of a cycle with respect to time zero its phase in degree is :

As Complete cycle is 360°

Therefore ¼ cycle is

¼ * 360 = **90°**

a sin wave is offset one forth of a cycle with respect to time zero its phase in radian is :

90° * $\frac{2\pi}{360} = \frac{\pi}{2} =$ **1.5708 radian**

Ans#2 : (A)

DIGITAL-TO-DIGITAL CONVERSION

Digital-to-digital encoding is the representation of digital information by a digital signal. When binary 1s and 0s generated by the computer are translated into a sequence of voltage pulses that can be propagated over a wire, this process is known as digital-to-digital encoding.

Digital-to-digital encoding is divided into three categories:

- Unipolar Encoding
- Polar Encoding
- Bipolar Encoding

Unipolar

- Digital transmission system sends the voltage pulses over the medium link such as wire or cable.
- In most types of encoding, one voltage level represents 0, and another voltage level represents 1.
- The polarity of each pulse determines whether it is positive or negative.
- This type of encoding is known as Unipolar encoding as it uses only one polarity.
- In Unipolar encoding, the polarity is assigned to the 1 binary state.
- In this, 1s are represented as a positive value and 0s are represented as a zero value.
- In Unipolar Encoding, '1' is considered as a high voltage and '0' is considered as a zero voltage.
- Unipolar encoding is simpler and inexpensive to implement.

Polar

- Polar encoding is an encoding scheme that uses two voltage levels: one is positive, and another is negative.
- By using two voltage levels, an average voltage level is reduced, and the DC component problem of unipolar encoding scheme is alleviated.

Bipolar

- Bipolar encoding scheme represents three voltage levels: positive, negative, and zero.
- In Bipolar encoding scheme, zero level represents binary 0, and binary 1 is represented by alternating positive and negative voltages.
- If the first 1 bit is represented by positive amplitude, then the second 1 bit is represented by negative voltage, third 1 bit is represented by the positive amplitude and so on. This alternation can also occur even when the 1bits are not consecutive.

Difference between signal element and data element :

Let us distinguish between a data element and a signal element. In data communications, our goal is to send data elements. A data element is the smallest entity that can represent a piece of information: this is the bit. In digital data communications, a signal element carries data elements. A signal element is the shortest unit (timewise) of a digital signal. In other words, 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.

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Ans#2 : (B)

The human voice normally contains frequencies from 0 to 4000 Hz. So the sampling rate and bit rate are calculated as follows:

Sampling rate = 2 * highest frequency

The approximately double-rate requirement is a consequence of the Nyquist theorem.

So = >

Sampling rate= 4000 X 2 = **8000 samples/s**

Bit rate = 8000X 7 = 56000 bps = **56 kbps**

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Ans#3 : (A)

1) Network Access Layer

- A network layer is the lowest layer of the TCP/IP model.
- A network layer is the combination of the Physical layer and Data Link layer defined in the OSI reference model.
- It defines how the data should be sent physically through the network.
- This layer is mainly responsible for the transmission of the data between two devices on the same network.
- The functions carried out by this layer are encapsulating the IP datagram into frames transmitted by the network and mapping of IP addresses into physical addresses.
- The protocols used by this layer are ethernet, token ring, FDDI, X.25, frame relay.

2) Internet Layer

- An internet layer is the second layer of the TCP/IP model.
- An internet layer is also known as the network layer.
- The main responsibility of the internet layer is to send the packets from any network, and they arrive at the destination irrespective of the route they take.

Following are the responsibilities of this protocol:

- **IP Protocol:** IP protocol is used in this layer, and it is the most significant part of the entire TCP/IP suite.
- **IP Addressing:** This protocol implements logical host addresses known as IP addresses. The IP addresses are used by the internet and higher layers to identify the device and to provide internetwork routing.
- **Host-to-host communication:** It determines the path through which the data is to be transmitted.
- **Data Encapsulation and Formatting:** An IP protocol accepts the data from the transport layer protocol. An IP protocol ensures that the data is sent and received securely, it encapsulates the data into message known as IP datagram.
- **Fragmentation and Reassembly:** The limit imposed on the size of the IP datagram by data link layer protocol is known as Maximum Transmission unit (MTU). If the size of IP datagram is greater than the MTU unit, then the IP protocol splits the datagram into smaller units so that they can travel over the local network. Fragmentation can be done by the sender or intermediate router. At the receiver side, all the fragments are reassembled to form an original message.

- **Routing:** When IP datagram is sent over the same local network such as LAN, MAN, WAN, it is known as direct delivery. When source and destination are on the distant network, then the IP datagram is sent indirectly. This can be accomplished by routing the IP datagram through various devices such as routers.

3) Transport Layer

- The transport layer is responsible for the reliability, flow control, and correction of data which is being sent over the network.
- The two protocols used in the transport layer are User Datagram protocol and Transmission control protocol

- **User Datagram Protocol (UDP)**
  - It provides connectionless service and end-to-end delivery of transmission.
  - It is an unreliable protocol as it discovers the errors but not specify the error.
  - User Datagram Protocol discovers the error, and ICMP protocol reports the error to the sender that user datagram has been damaged.

- **Transmission Control Protocol (TCP)**
  - It provides a full transport layer services to applications.
  - It creates a virtual circuit between the sender and receiver, and it is active for the duration of the transmission.
  - TCP is a reliable protocol as it detects the error and retransmits the damaged frames. Therefore, it ensures all the segments must be received and acknowledged before the transmission is considered to be completed and a virtual circuit is discarded.
  - At the sending end, TCP divides the whole message into smaller units known as segment, and each segment contains a sequence number which is required for reordering the frames to form an original message.
  - At the receiving end, TCP collects all the segments and reorders them based on sequence numbers.

4) Application Layer

- An application layer is the topmost layer in the TCP/IP model.
- It is responsible for handling high-level protocols, issues of representation.
- This layer allows the user to interact with the application.
- When one application layer protocol wants to communicate with another application layer, it forwards its data to the transport layer.
- There is an ambiguity occurs in the application layer. Every application cannot be placed inside the application layer except those who interact with the

communication system. For example: text editor cannot be considered in application layer while web browser using HTTP protocol to interact with the network where HTTP protocol is an application layer protocol.

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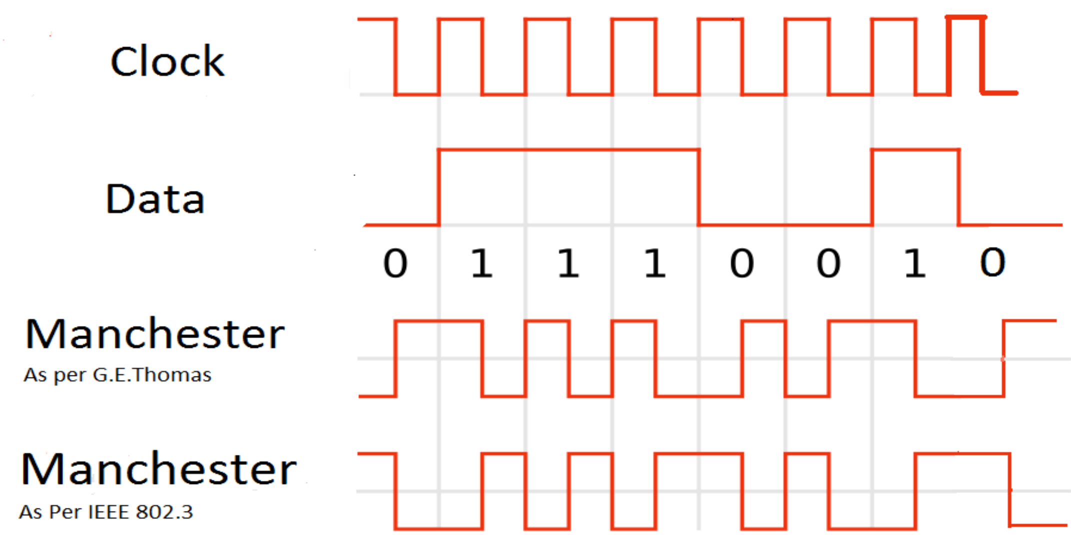
Ans#3 : (B)

Manchester Coding :

In telecommunication and data storage, **Manchester code** (also known as **phase encoding**, or **PE**) is a line code in which the encoding of each data bit is either low then high, or high then low, for equal time. It is a self-clocking signal with no DC component. As a result, electrical connections using a Manchester code are easily galvanically isolated.

The first of these was first published by G. E. Thomas in 1949 and is followed by numerous authors (e.g., Andy Tanenbaum).[3] It specifies that for a 0 bit the signal levels will be low-high (assuming an amplitude physical encoding of the data) - with a low level in the first half of the bit period, and a high level in the second half. For a 1 bit the signal levels will be high-low.

The second convention is also followed by numerous authors (e.g., William Stallings)[4] as well as by IEEE 802.4 (token bus) and lower speed versions of IEEE 802.3 (Ethernet) standards. It states that a logic 0 is represented by a high-low signal sequence and a logic 1 is represented by a low-high signal sequence.



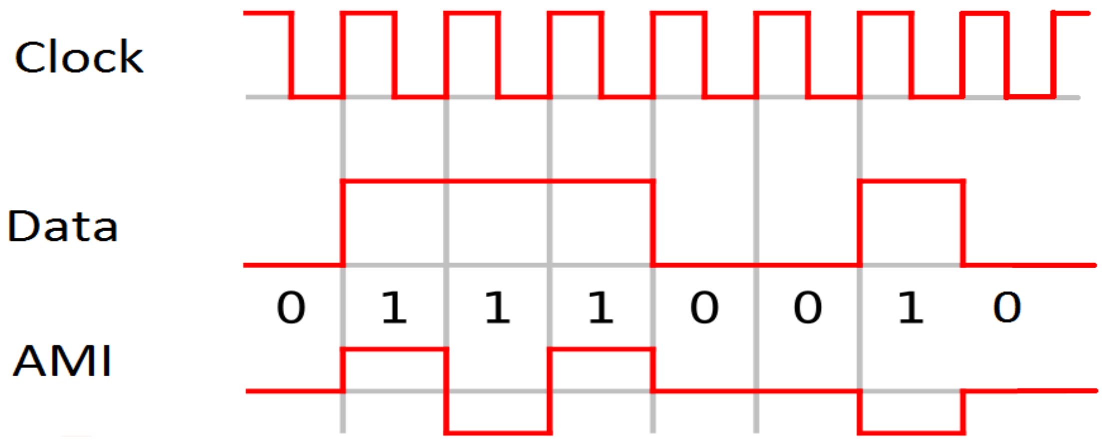
So data encodes to **1001010110100110**

Bipolar

- Bipolar encoding scheme represents three voltage levels: positive, negative, and zero.
- In Bipolar encoding scheme, zero level represents binary 0, and binary 1 is represented by alternating positive and negative voltages.
- If the first 1 bit is represented by positive amplitude, then the second 1 bit is represented by negative voltage, third 1 bit is represented by the positive amplitude and so on. This alternation can also occur even when the 1bits are not consecutive

Bipolar AMI :

One kind of bipolar encoding is a paired disparity code, of which the simplest example is **alternate mark inversion**. In this code, a binary 0 is encoded as zero volts, as in unipolar encoding, whereas a binary 1 is encoded alternately as a positive voltage or a negative voltage. The name arose because, in the context of a T-carrier, a binary '1' is referred to as a "mark", while a binary '0' is called a "space"



So data encodes to **0 +1 -1 +1 0 0 -1 0**

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End Of Paper