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**Program : BSSE**
**Course Code: 102007049**
**Course Title: Data Communication and Networks**
**Mid – Term Online Examination(Summer 2020)**
**Instructor: Engr. Ghassan Husnain**
**Total Marks: 30**
**Time Allowed: 4 Hours**

**Note: Attempt all Questions**

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**Q1) Answer the following short questions briefly. Each question carries equal marks. (14)**

1) What are the differences between Frame Relay and Asynchronous Transfer Mode (ATM)?
2) A signal with 500 mill watts power passes through 10 devices, each with an average noise of 5 microwatts. What is the SNR? What is the $SNR_{dB}$?
3) Which signal has a wider bandwidth, a sine wave with a frequency of 10 Hz or a sine wave with a frequency of 20 Hz?
4) Distinguish between a low pass channel and a band pass channel.
5) What is the Bit-Rate for a signal in which 1 bit lasts 0.001

seconds?

6) Briefly explain different metrics to measure the Performance of the Network?

7) Briefly explain one responsibility of Hub, Switches, Bridge, Routers, Gateway and Repeaters?

**ANSWER(1):**

1) What are the differences between Frame Relay and Asynchronous Transfer Mode (ATM)?

Ans 1: The difference between frame relay and ATM lies in the speed of transmission, efficiency, accurate delivery of the packets, etcetera. The frame relay provides 1.544 Mbps or 44.736 Mbps. On the other hand, ATM provides 51 Mbps or 155 Mbps.

2) A signal with 500 mill watts power passes through 10 devices, each with an average noise of 5 microwatts. What is the SNR? What is the $SNR_{dB}$?

Ans 2:

Given:

Signal power for 10 devices = 500 mill watts

= 500000 microwatts

(since 1 mill watt= 1000 microwatts)

Noise = 5 microwatts

Signal noise for 10 devices= 5*10 = 50 microwatts
SNR= signal power/ signal noise
= 500000/50
=10000 (or) $10^4$
SNRdb= 10 log10[SNR]
=10 log10[10000]
= 10 log10[$10^4$]
= 10*4
=40

3)Which signal has a wider bandwidth, a sine wave with a frequency of 10 Hz or a sine wave with a frequency of 20 Hz?

Answer(3):

Theoretically, a perfect sine wave has zero bandwidth regardless of its frequency. Bandwidth is a measure of a signal's deviation from a perfect sine wave and ability to carry information. A perfect sine wave contains no information at all since it never changes.

4) Distinguish between a low pass channel and a band pass channel.

Answer(4):

Low-pass refers to a channel with a bandwidth that starts from zero while a bandpass is a channel with a bandwidth that does not start from zero. Low-pass is used in base-band and bandpass is used in broadband.
Low-pass has one threshold frequency. Band-pass has two threshold frequencies.
Low pass channel which start from 0 frequency mean low frequency.
A low-pass channel has bandwidth with frequency between 0 and infinity where band-pass channel has bandwidth with frequency between f1 and f2 .

5) What is the Bit-Rate for a signal in which 1 bit lasts 0.001 seconds?

Ans 5:
Bit rate = 1/ 0.001 = 1000 bits/second = 1Kbps

6) Briefly explain different metrics to measure the Performance of the Network?
Ans 6:

When you're evaluating your network performance, there are several different metrics that you can analyse.

Network performance can be affected by a number of different factors Listed Below:

**1.Bandwidth usage**

Bandwidth is the maximum data transmission rate possible on a network.

**2. Throughput**

Throughput measures your network's actual data transmission rate, which can vary wildly through different areas of your network.

**3. Latency**

Latency is the delay that happens between a node or device requesting data and when that data is finished being delivered.

**4. Packet loss**

Packet loss examines how many data packets are dropped during data transmissions on your network.

**5. Re transmission**

When packets are lost, the network needs to retransmit it to complete a data request.

**6. Availability**

Network availability, also know as uptime, simply measures whether or not the network is currently operational.

**7. Connectivity**

Connectivity refers to whether or not the connections between the nodes on your network are working properly.

7)Briefly explain one responsibility of Hub, Switches, Bridge, Routers, Gateway and Repeaters?

Ans 7:

**Hub:** A hub is basically a multi port repeater. A hub connects multiple wires coming from different

branches, for example, the connector in star topology which connects different stations.

**Switch:** A switch is a data link layer device. The switch can perform error checking before forwarding data, that makes it very efficient as it does not forward packets that have errors and forward good packets selectively to correct port only.

**Bridge:** A bridge operates at data link layer. A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol.

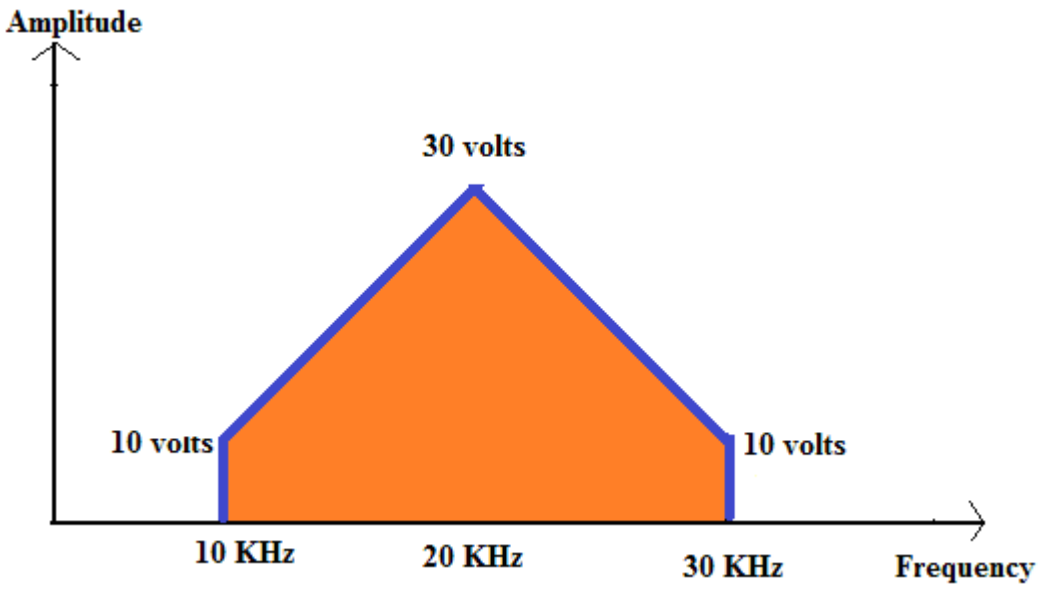
**Routers:** Router is mainly a Network Layer device. Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets. Router divide broadcast domains of hosts connected through it.

**Gateway:** A gateway, as the name suggests, is a passage to connect two networks together that may work upon different networking models. They basically work as the messenger agents that take data from one system, interpret it, and transfer it to another system.

**Repeater:** A repeater operates at the physical layer. Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted so as to extend the length to which the signal can be transmitted over the same network.

**Q2) Sec a) A non-periodic composite signal contains frequencies from 10 to 30 KHz. The peak amplitude is 10 V for the lowest and the highest signals and is 30 V for the 20-KHz signal. Assuming that the amplitudes change gradually from the minimum to the maximum, draw the frequency spectrum. (2)**

## Answer 2a:




**Q2) Sec b) A signal travels from point A to point B. At point A, the signal power is 200 W. At point B, the power is 190 W. What is the attenuation in decibels? (2)**

## Answer 2(b):

In the given case attenuation in dB =

$10 \log 100/90 = 10 (\log(10) - \log(9)) = 0.46\text{dB} \approx 0.5\text{dB}$

**Q2) Sec c)** What is the channel capacity for a tele-printer channel with a 600-Hz bandwidth and a signal-to-noise ratio of 7 dB, where the noise is white thermal noise.

**Answer 2(c):**

Using Shannon's equation: $C = B \log_2 (1 + SNR)$

We have $W = 600$ Hz $(SNR)_{dB} = 7$

Therefore, $SNR = 10^{0.7}$

$C = 600 \log_2 (1 + 10^{0.7}) = 600 \log_2 (6.011) = 1552.56$ bps

**Q3) Sec a) Briefly explain the main responsibilities of each layer of TCP/IP Protocol Suite?**

**Answer 3(a):**

TCP/IP specifies how data is exchanged over the internet by providing end-to-end communications that identify how it should be broken into packets, addressed, transmitted, routed and received at the destination. TCP/IP requires little central management, and it is designed to make networks reliable, with the

ability to recover automatically from the failure of any device on the network.

**IP Protocol:**

The IP protocol and its associated routing protocols are possibly the most significant of the entire TCP/IP suite. IP is responsible for the following:

- **IP addressing**– The IP addressing conventions are part of the IP protocol. Designing an IPv4 Addressing Scheme introduces IPv4 addressing and Pv6 Addressing Overview introduces IPv6 addressing.

- **Host-to-host communications** – IP determines the path a packet must take, based on the receiving system's IP address.

- **Packet formatting**– IP assembles packets into units that are known as data grams. Data grams are fully described Layer: Where Packets Are Prepared for Delivery.

- **Fragmentation**– If a packet is too large for transmission over the network media, IP on the sending system breaks the packet into smaller fragments. IP on the receiving

system then reconstructs the fragments into the original packet.

## TCP Protocol

TCP enables applications to communicate with each other as though they were connected by a physical circuit. TCP sends data in a form that appears to be transmitted in a character-by-character fashion, rather than as discrete packets. This transmission consists of the following:

- Starting point, which opens the connection
- Entire transmission in byte order
- Ending point, which closes the connection.

TCP attaches a header onto the transmitted data. This header contains many parameters that help processes on the sending system connect to peer processes on the receiving system.

TCP confirms that a packet has reached its destination by establishing an end-to-end connection between

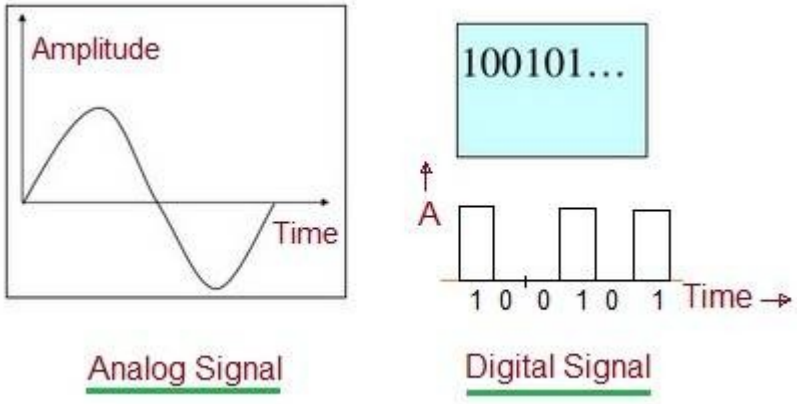
sending and receiving hosts. TCP is therefore considered a “reliable, connection-oriented” protocol.

**Q3) Sec b)** Briefly explain the two main approaches to transmit digital signal with the help of diagram (if any)?

**Answer(b):**

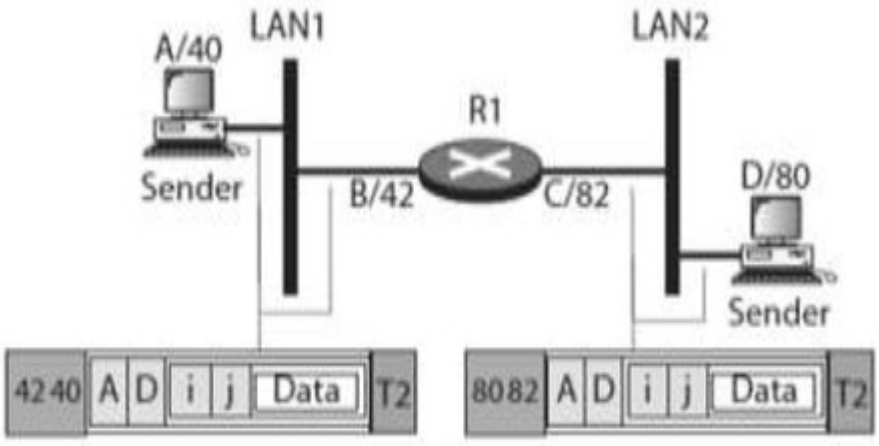
A digital signal is a signal that is being used to represent data as a sequence of discrete values; at any given time it can only take on, at most, one of a finite number of values. This contrasts with an analog signal, which represents continuous values; at any given time it represents a real number within a continuous range of values.

In digital electronics, a digital signal is a pulse train (a pulse amplitude modulated signal), i.e. a sequence of fixed-width square wave electrical pulses or light pulses, each occupying one of a discrete number of levels of amplitude. A special case is a logic signal or a binary signal, which varies between a low and a high signal level.




**Q3) Sec c) For figure below, computer A sends a message to computer D via LAN 1, router R1, and LAN 2. Assume that the communication is between a process running at computer A with port address *i* and a process running at computer D with port address *j*. Show the contents of the Packets and Frames at the network, data link and transport layer for each hop interface.**

**Answer 3(c):**



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