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Assignment No. 1
Computer Networks

- Q.No. 1 A color image uses 16 bits to represent a pixel. What is the maximum number of different colors that can be represented?
- Q.No. 2 Assume six devices are arranged in a mesh topology. How many cables are needed? How many ports are needed for each device?
- Q.No. 3 For each of the following four networks, discuss the consequences if a connection fails.
- a. Five devices arranged in a mesh topology
 - b. Five devices arranged in a star topology (not counting the hub)
 - c. Five devices arranged in a bus topology
 - d. Five devices arranged in a ring topology
- Q.No. 4 What are the responsibilities of the data link layer, network layer, and transport layer in the Internet model?
- Q.No. 5 Distinguish between baseband transmission and broadband transmission.
- Q.No. 6 What is the bandwidth of a signal that can be decomposed into five sine waves with frequencies at 0, 20, 50, 100, and 200 Hz? All peak amplitudes are the same. Draw the bandwidth.
- Q.No. 7 A device is sending out data at the rate of 1000 bps.
- a. How long does it take to send out 10 bits?
 - b. How long does it take to send out a single character (8 bits)?
 - c. How long does it take to send a file of 100,000 characters?
- Q.No. 8 The attenuation of a signal is -10 dB. What is the final signal power if it was originally 5 W?
- Q.No. 9 If the bandwidth of the channel is 5 Kbps, how long does it take to send a frame of 100,000 bits out of this device?
- Q.No. 10 We have a channel with 4 KHz bandwidth. If we want to send data at 100 Kbps, what is the minimum SNRdB? What is SNR?

1) With 16 bits, we can represent upto 2^{16} different colours.

(2) Cable links: $\frac{n(n-1)}{2} = \frac{(6 \times 5)}{2} = 15$

Number of ports: $(n-1) = 5$ ports needed per device.

(3) (a) Mesh topology: If one connection fails, the other connections will still be working.

(b) Star topology: The other devices will still be able to send data through the hub; there will be no access to the device which has the failed connection to the hub.

(c) Bus topology: All transmission stops if the failure is in the bus. If the drop-line fails, only the corresponding device cannot operate.

(d) Ring topology: The failed connection may disable the whole network unless it is a dual ring or there is a by-pass network.

(4) Data link layer: Responsible for the error-free transfer of data frames.

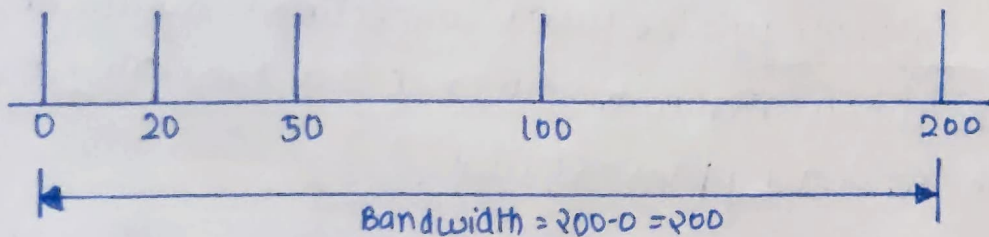
Network layer: Responsible for routing and forwarding the packets.

Transport layer: Responsible for transferring data completely.

(5)

<u>Baseband Transmission</u>	<u>Broadband Transmission</u>
(1) Digital signaling is used (2) Signals can only travel over short distances (3) Bidirectional in nature (4) Cheaper to design	(1) Analog signaling is used. (2) Signals can be travelled over long distances without being attenuated (3) unidirectional in nature. (4) Expensive to design.

(6)



(7)

(a) $(10/1000)s = 0.01s$

(b) $(8/1000)s = 0.008s = 8ms$

(c) $((100000 \times 8)/1000)s = 800s$

(8) Here,

$$-10 \text{ dB} = 10 \log_{10}(P_2/5)$$

$$\log_{10}(P_2/5) = -1$$

$$(P_2/5) = 10^{-1}$$

$$\underline{\underline{P_2 = 0.5 \text{ W}}}$$

(9) Here,

$$\text{Bandwidth} = 5 \text{ kbps, frame} = 100000 \text{ bits.}$$

$$\therefore 100000 \text{ bits} / 5 \text{ kbps}$$

$$= \underline{\underline{20 \text{ sec}}}$$

(10) Given,

$$\text{Bandwidth} = 4 \text{ kHz,}$$

$$\text{Data rate} = 100 \text{ kbps}$$

we know,

$$C = B * (\text{SNR}_{\text{dB}}/3)$$

$$\Rightarrow \text{SNR}_{\text{dB}} = (3 * C) / B.$$

$$\text{minimum } \text{SNR}_{\text{dB}} = (3 * 100) / 4 = 75$$

$$\text{So the minimum SNR} = 10^{\text{SNR}_{\text{dB}}/10} = 10^{7.5} \approx 31622776$$

SNR is signal to noise ratio.