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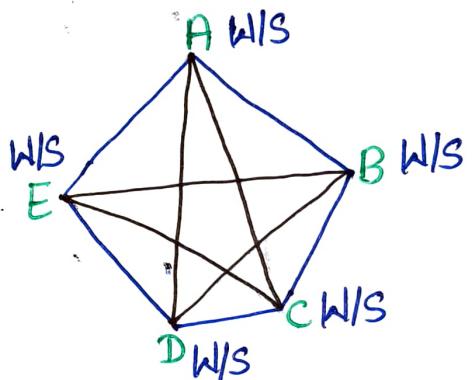
PAPER : COMPUTER
NETWORK

SECTION : "A"

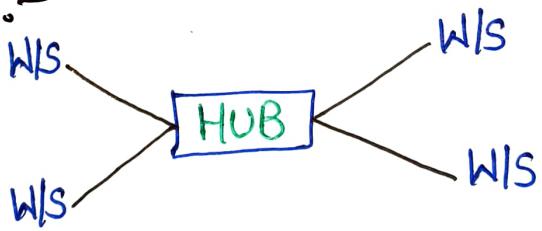
1. Write the names of four basic networks topologies. Draw a hybrid topology with a ring backbone connecting two bus backbones. Each ring backbone connects three star networks.

Ans :- four basic network topology are :-

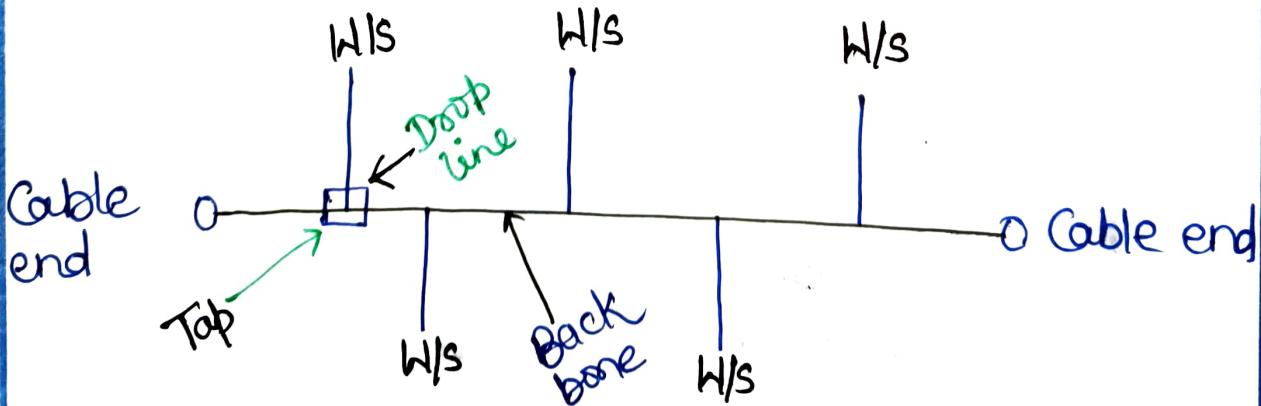
i) Mesh topology :-



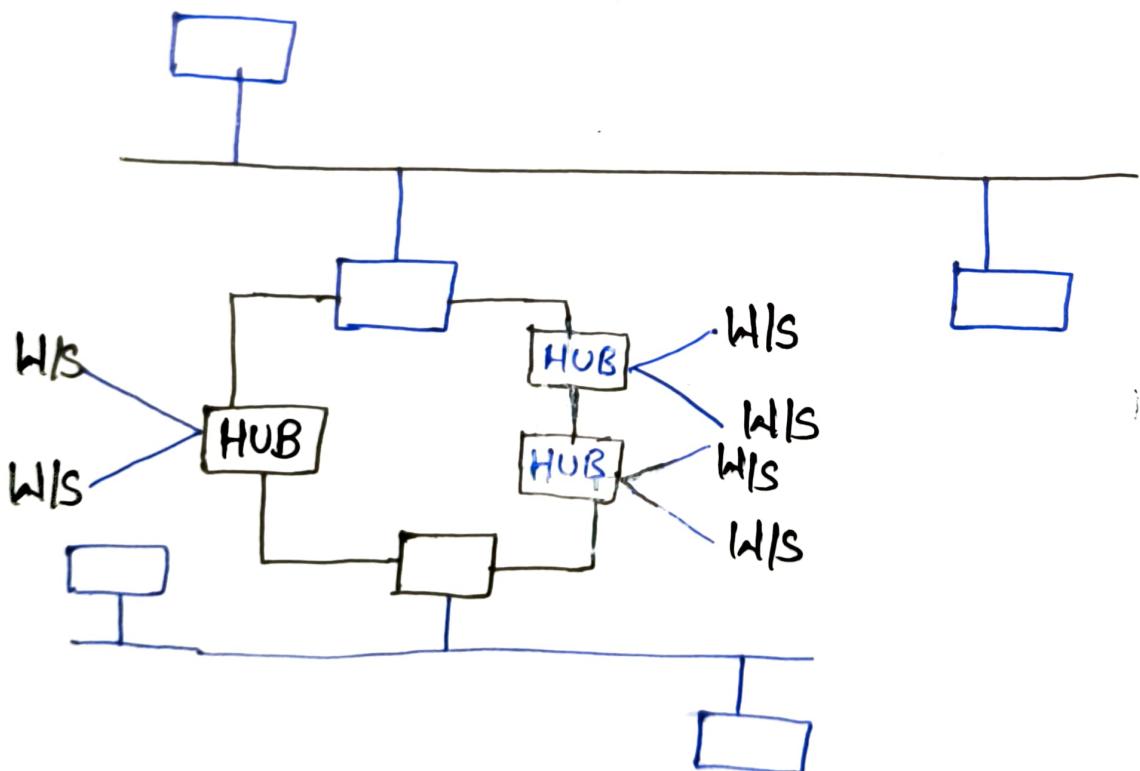
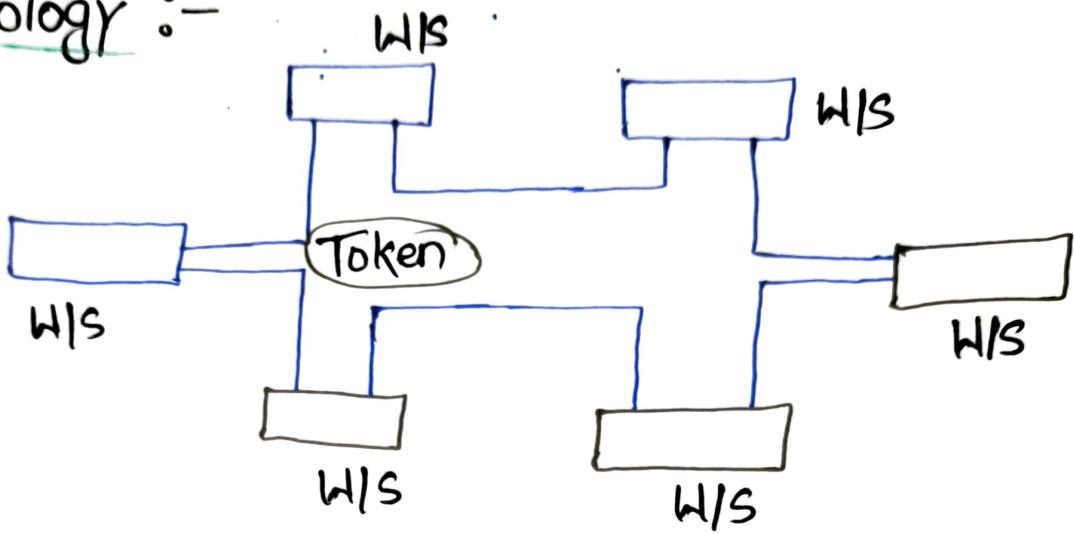
ii) Star topology :-



iii) Bus topology :-



iv) Ring topology :-



2. Explain in brief about each networking device: Repeater, Bridge, Router and gateway.

- a) Repeater :- It is a type of network node that amplifies incoming signals and rebroadcasts them over a wider area or higher network layer than the original signal.
- b) Bridge :- A bridge operates at the data link layer. It connects and manages traffic between network segments.
- c) Router :- A router is a device like a switch that routes data packets based on their IP addresses. It is mainly a network layer device.
- d) gateway :- A gateway, as the name suggests is a passage to connects two networks that may work upon different networking models. It interfaces between different networks, translating protocols for communications.

3. A device is sending out data at the rate of 1000 bps. How long does it take to send out

- i) 10 bits
- ii) A single character (if a single character is represented by 8-bits).
- iii) A file of 100,000 characters.



Ans :- Time = $\frac{\text{No. of bits}}{\text{Data rate}}$

$$\text{data rate} = 1000 \text{ bps.}$$

i) To send 10 bits

$$\text{Time} = \frac{10}{1000} = 0.01 \text{ Sec.}$$

ii) A Single character (8 bits)

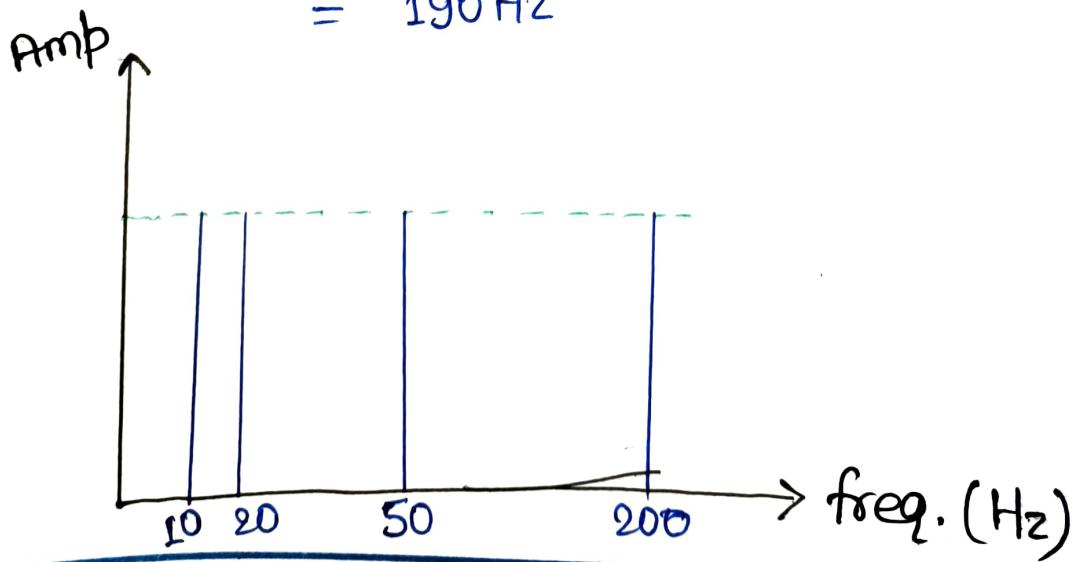
$$\text{Time} = \frac{8}{1000} = 0.008 \text{ Sec}$$

iii) A file of 100,000 characters

$$\begin{aligned}\text{Time} &= 0.008 \times 100,000 \\ &= 800 \text{ Sec.}\end{aligned}$$

4. What is the bandwidth of a signal that can be decomposed into four sine waves with frequencies at 10 Hz, 20 Hz, 50 Hz and 200 Hz? Draw the frequency spectrum, if all have the same maximum amplitude.

Ans: Bandwidth = $(200 - 10) \text{ Hz} [f_H - f_L]$
 $= 190 \text{ Hz}$



5. Distinguish between Single-bit error and burst error. Explain how the length of burst error depends on the data rate.

Single-bit error

- It typically affects only one bit position within the data packets.
- A single bit error occurs when one bit in a data stream is flipped from 0 to 1.
- This can happen randomly due to noise or interface in the transmission medium.

Burst error

- Burst errors often occur due to localized disturbances or faults.
- A burst error refers to multiple consecutive bits in a data stream being corrupted simultaneously.
- Burst errors are often caused by physical phenomena such as signal attenuation.

The length of a burst error depends on the data rate because higher data rates mean more bits are transmitted in the same time frame. As a result, any interference or noise affecting the transmission has a greater chance of corrupting multiple consecutive bits, leading to longer burst errors.

6. A code 1110101101 was received and found to be in error. Using the Hamming encoding algorithm, determine the original code sent.

Ans:-

1 1 1 1 0 1 0 1 1 0 1
1 2 3 4 5 6 7 8 9 10 11

In Hamming code, redundant bit are Power of 2 (1, 2, 4, 8, etc)

Redundant bit 1 covers position (1, 3, 5, 7, 9, 11)

$$\text{Parity: } (1+1+0+0+0+1) \bmod 2 = 1$$

Redundant bit 4: [4, 5, 6, 7]

$$\text{Parity: } (0+0+1+0) \bmod 2 = 1$$

Redundant bit 8: [8, 9, 10, 11]

$$\text{Parity: } (1+0+1+1) \bmod 2 = 1$$

Received Parity bits: 1111

Calculated Parity bits: 1111

Since, the received and calculated Parity bits match, there are no errors detected.

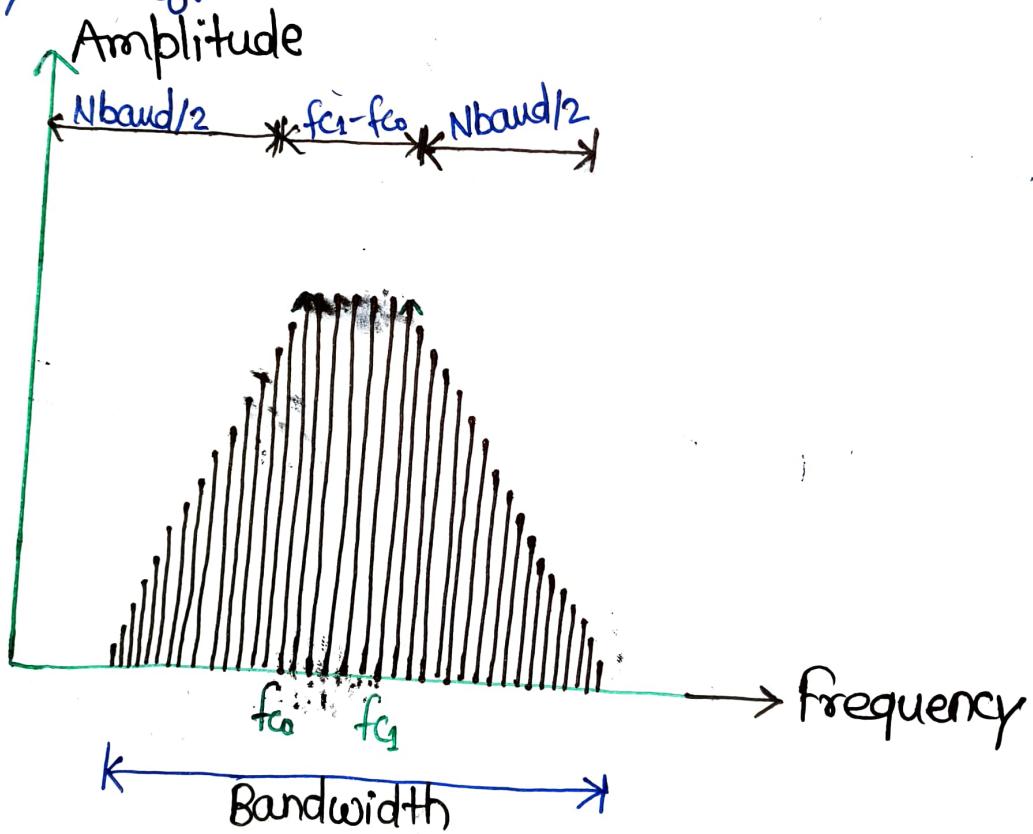
Therefore, the Original code sent is indeed 11110101101

7. Explain the frequency shifting keying technique through proper waveforms. Also show its bandwidth.

Ans: In frequency shifting keying, frequency of the carrier signal is varying to represent binary 1 or 0. Here both amplitude and phase remain constant.

It avoids most of the noise problems of ASK, as the receiving device is looking for specific frequency changes over a given no. of periods, it can ignore the voltage spikes.

Bandwidth for FSK :- The Bandwidth required for FSK transmission is equal to the baud rate of the signal + the frequency shift.



$$\begin{aligned}
 \text{Bandwidth} &= N \text{ baud}/2 + (f_C1 + f_C0) + N \text{ baud}/2 \\
 &= (f_C1 - f_C0) + N \text{ baud}
 \end{aligned}$$



8. Find the max bit rates for an FSK signal if the BW of the medium is 12,000 Hz and the difference b/w the two carriers must be at least 2000 Hz. Transmission is in full-duplex mode.

Ans:- Because the transmission in full ~~full~~ duplex only 6000Hz is allocated for each section.

$$\text{Baud rate} = \text{BW} = 12000 \text{ Hz}$$

$$\text{BW} = \text{baud rate} + f_{c_1} - f_{c_0}$$

$$\begin{aligned}\text{Baud rate} &= \text{BW} - (f_{c_1} - f_{c_0}) \\ &= 6000 - 2000 \\ &= 4000\end{aligned}$$

But, baud rate is the same as the bit rate. of the bit rate is 4000 bps.

9) ACK 7 has been received by the sender in a go-back-n Sliding windows System. Now frames 7, 0, 1, 2 and 3 are sent. For each of the following separate scenarios, discuss the significance of the receiving of

a) An ACK 1

b) An ACK 4

c) An ACK 3

d) A NAK 1

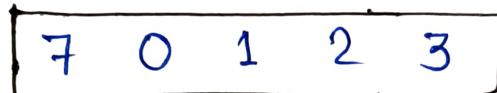
e) A NAK 3

f) A NAK 7

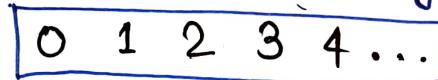
Ans:- i) Ack 1

An Ack 1 :- Receiving ACK1 after sending frame 7, 0, 1, 2 and 3 means that frame 7 and 0 have been received and proceed correctly.

a) initial window (after receiving ACK7)



b) Scenario a) Receiving ACK1 :



b) ACK 4 :- Receiving ACK4 indicates that frames upto and including frame 4 have been successfully received. The sender can advance its windows to include frame 5 and continue sending subsequent frames.

c) ACK 3 :- frames upto and including frame 3 have been received. It means the receiver is acknowledgement frames that the sender has already transmitted but not necessarily in the order they are sent.

d) NAK 1 :- A negative acknowledgement for frame 1 implies that the receiver detected an error in frame 1 or it hasn't been received. The sender needs to retransmit frame 1.

e) NAK 3 :- Similar to NAK 1, but specifically indicating an error or missing frame 3. The sender would retransmit frame 3 and possibly all subsequent frames in its window.

f) NAK 7 :- Receiving a NAK for frame 7 implies that the receiver is requesting a retransmission of frame 7. Since Go-Back-N operates on cumulative ack, the sender would need to resend frame 7 and all frames following it in its windows.

- Sender must transmitts frame 7 and all Subsequent frame in window.