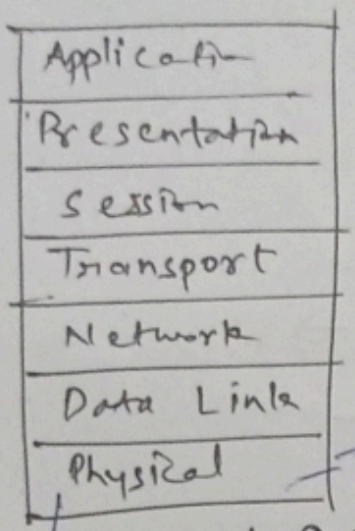
Computer Network

{ Devices ⇒ Send ⇌ Recive } Network

⇒ Connection B/w node is b/w as CN

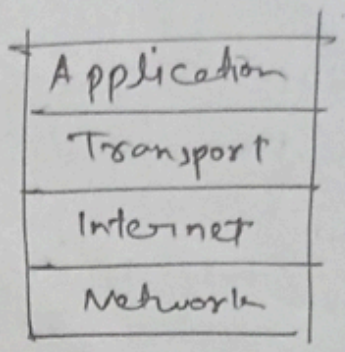
OSI → Open System Interconnection



Topology way to connect node

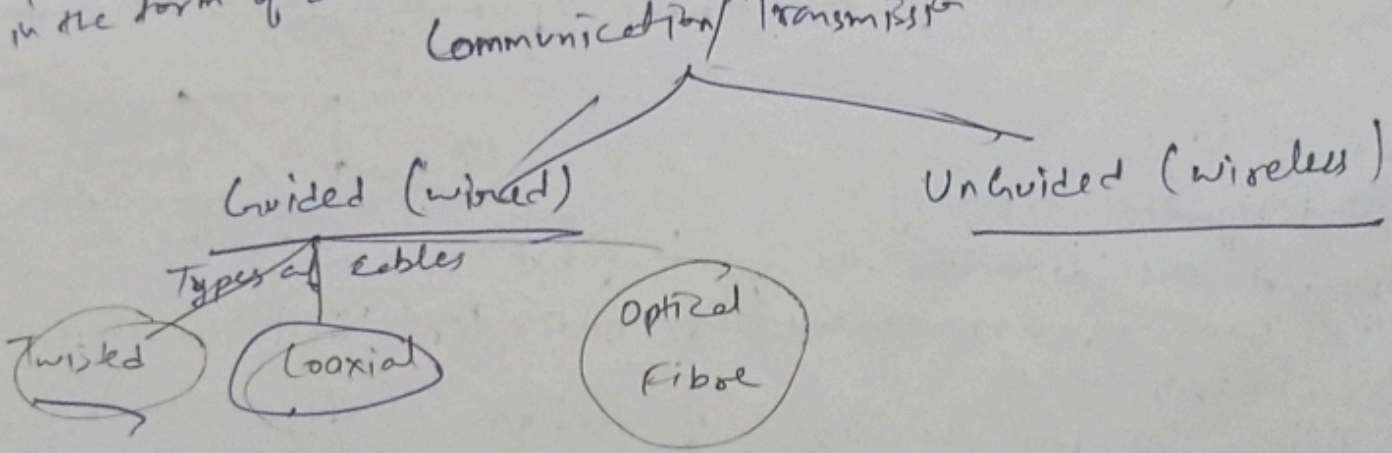
7 layers of OSI Model

Transmit the data in the form of bits



TCP/IP

Transmission Control Protocol
Internet Protocol



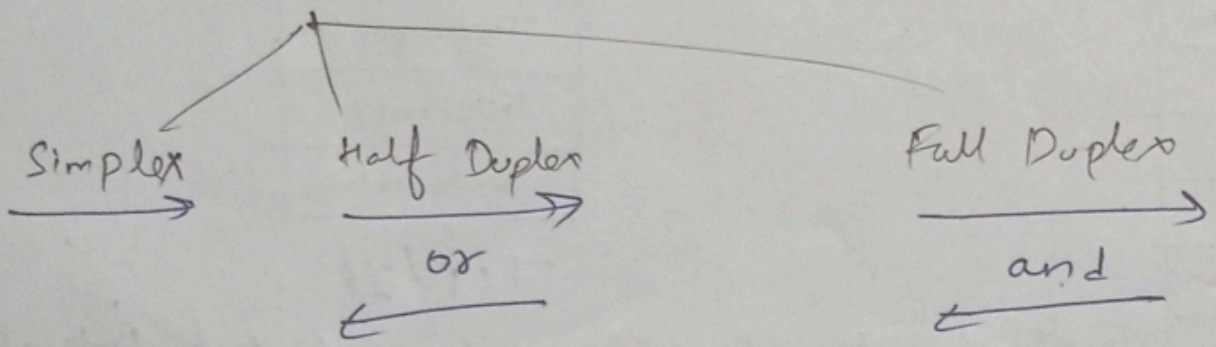
Twisted Pair :- Pair of cables are twisted together.

- The frequency range of signal which can be carried by twisted pair varies from 1 to 3.5 KHz
- It is used for shorter distance

Coaxial
- It is a copper cable with metal shielding
- It is often used in television network
- It has 10 MPS, of upto 200 meter.

Optical fibre.
- It is a glass based cable that transmit the signal with the speed of light
- It has 100 MPS ≡ of upto 2Km.

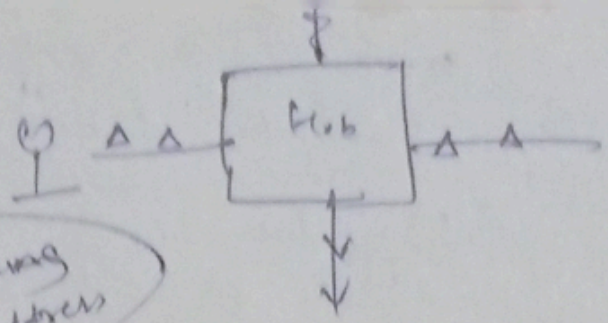
Transmition Modes



(*) Topology :- The way of arrangement of nodes in a Network

Physical layer
→ To design the topology
→ Transmit the data in the form of bit
→ The way of arrangment of nodes in a network (currently it is not used)

Connecting Device
(*) Amplifier :- It boost the signal of strength (attenuation) that increases
(*) Repeater :- It increases the attenuation signal on it original strength. It is better than amplifier.
(*) Hub :- It is also a connecting devices that is uses in a physical layer to get signal strength
It is a multiport repeater. Hub is used in intelligent devices. because they cannot read the MAC address & ip address.

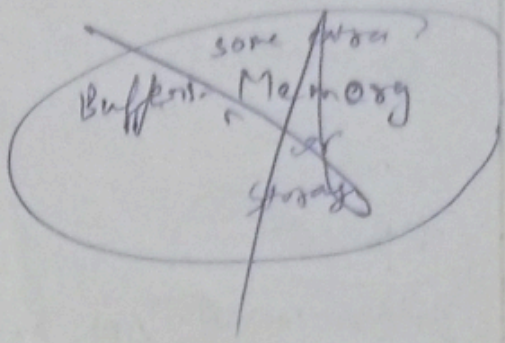


It need have Buffering of space to store address

Node

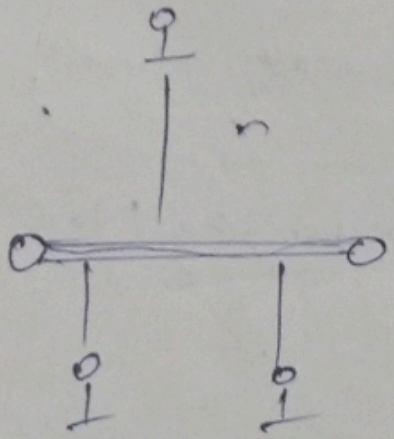
MAC (Physical)
48 Bits address length
→ MIC card

IP (Logical)
- IPV4 → 32 bits
- IPV6 → 128 bits



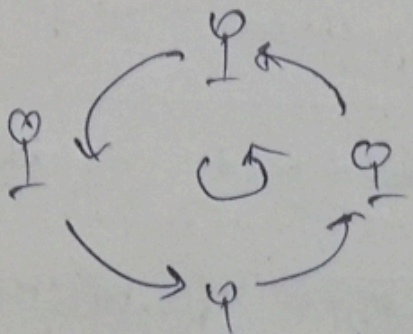
Topology

Bus



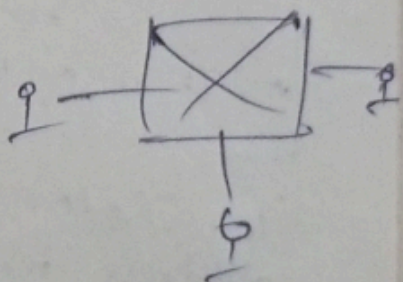
→ (n+1) No. of Cable

Ring



→ (n+1) no of cable
unidirectional

Star

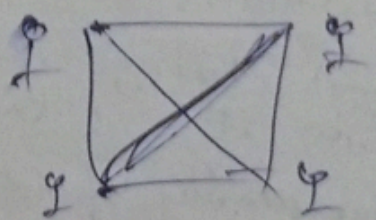


→ (n) / no of cable

Mesh topology: In mesh topology every node is connected through a dedicated path. This is called mesh topology

→ Most reliable topology

→ high complexity
→ Costly



→ n(n-1)/2
no. of cable

Connecting devices

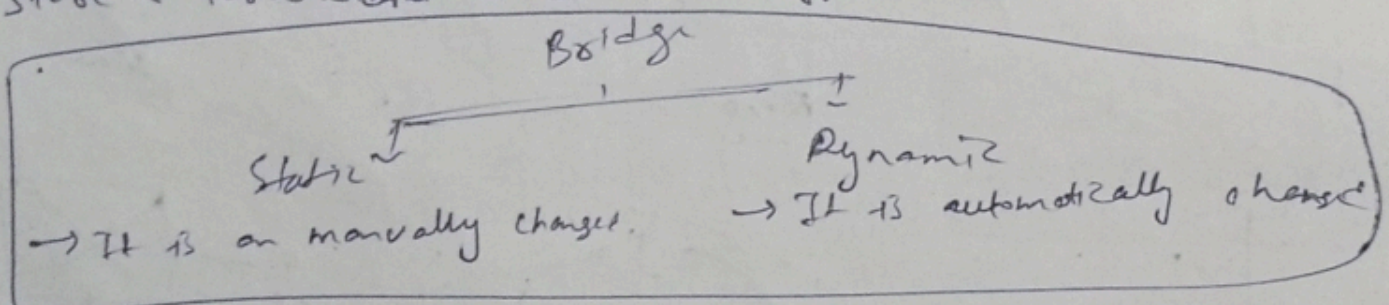
1. Amplifier
2. Repeater
3. Hub

Q. what is the difference b/w Repeater & hub?

Q. Why the connecting devices used at the physical layer are not intelligent?

Bridge:

1. Bridge connect to Same LAN are connected present within Network
2. It used in a data link layer.
3. It is a Two port device
4. It is an intelligent device
5. It is a connecting devices used at data link layer
6. They have the ability to read the Mac address (MAC bits)
7. Store & forward since the buffer.



& later is forwards to its corresponding Mac address node

8. There are two types of bridges
   1. Static Bridge 2. Dynamic Bridge

1. Static Bridge:- When a new node is added with in the network the table of the bridge containing the Mac address & the table is updated by the administrator
2. Dynamic Bridge:- When a new node is added with in the network the table of the brige is automatically updated with the corresponding Mac address of the new node.

Saurabh i-campus.

4000
3200

1000 → 800

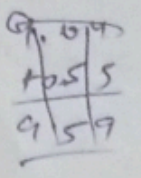
200

Switch :- Multiport

Layer two switch :- used at Data Link Layer

Layer 3 switch: Used at the Network layer

~~(*) Bridge connect to LAN~~



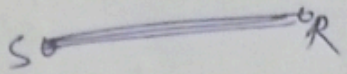
* Switching :-

It is two types

① Circuit Switching ② Packet Switching

(**) Circuit Switching :-

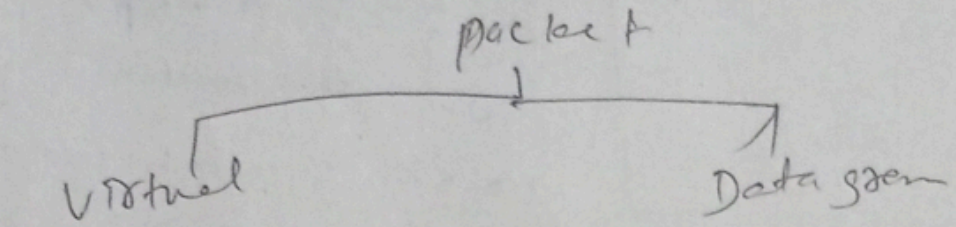
→ was used for telephonic services.
→ No headers are required to send the data.
→ The data flows continuously.
→ Efficiency is less.



→ Delay is less
→ It uses a dedicated path b/w sender & receiver

(**) Packet Switching

→ It is used at data link layer & network layer & beyond.
→ It stores the packet & these forward it to destination.
→ The concept of pipelining is also used
→ Efficiency of packet switching is greater than circuit switching.
→ Delay is greater than circuit switching because we follow the concept of store & forward.



Datagram switching

→ It is a packet switching technique that treats each packet or data gram as a seperate aid entity.

→ Intermediate node access the packet header & select appropriate link to a different node closer destinatio

Advantage :-
→ Scalability
→ lower latency

packet
Virtual Switching

→
Line coding

→ line coding is the representation of the verbal digital signal

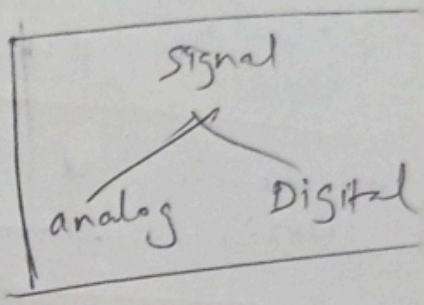
① DC component :-
→ when the voltage level remains constant for long period of time. There is an increase in the low frequency of the signal.

② Self Synchronization :-
The clock and sender and the reciver must have the same bit interval. If the reciver clock as faster or slower it

will miss interprit the incomming bit stream.

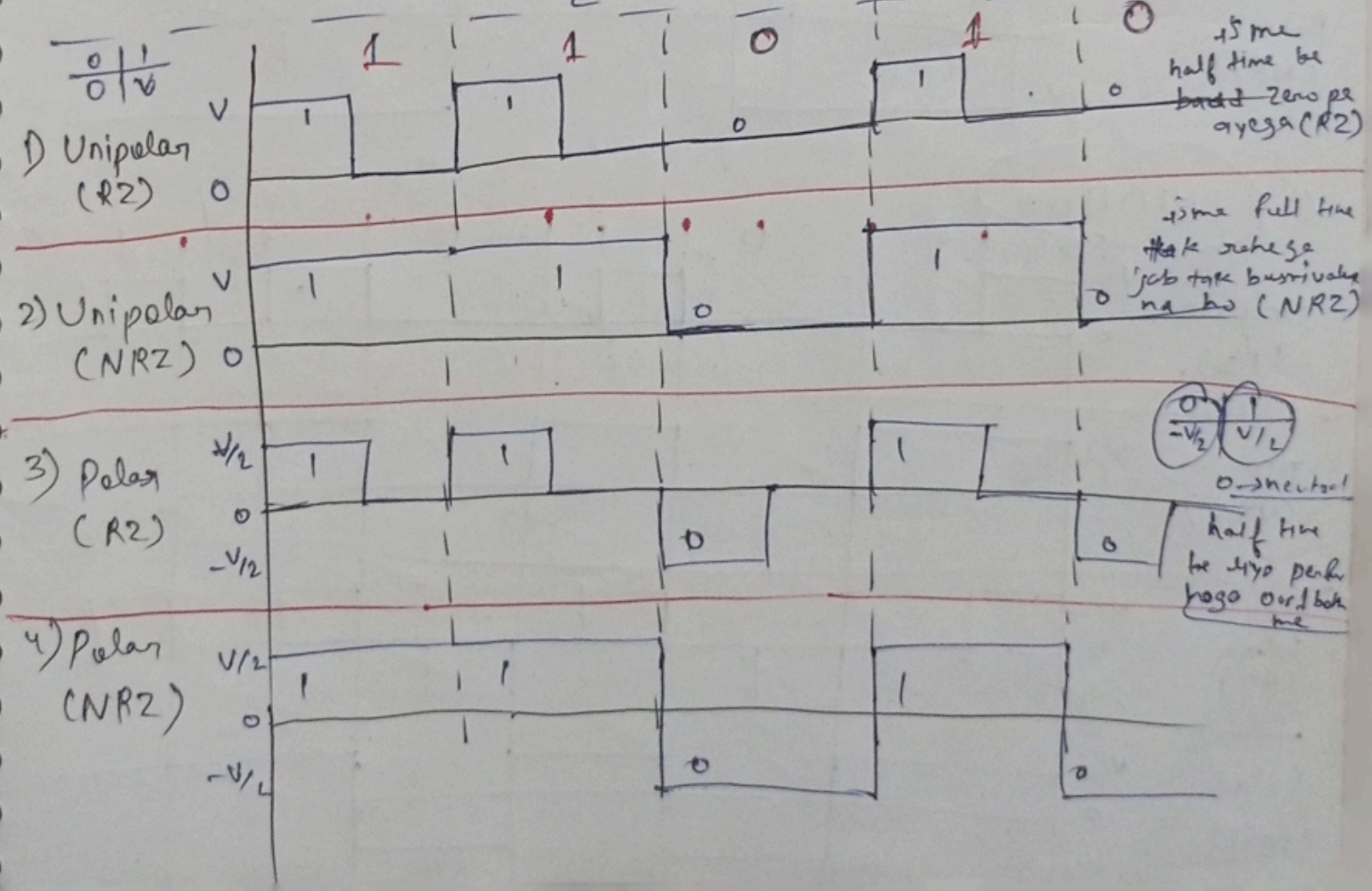
Line coding

- Unipolar {along 1 axis}
- Polar {voltage on both axis}
  - NRZ (Non Return to Zero)
  - NRZ-Inversion
- Bipolar {0, V, -V}
- Multilevel (Multiline)



Unipolar :- 0 to V

Bipolar :- $-V/2$ to $\frac{V}{2}$

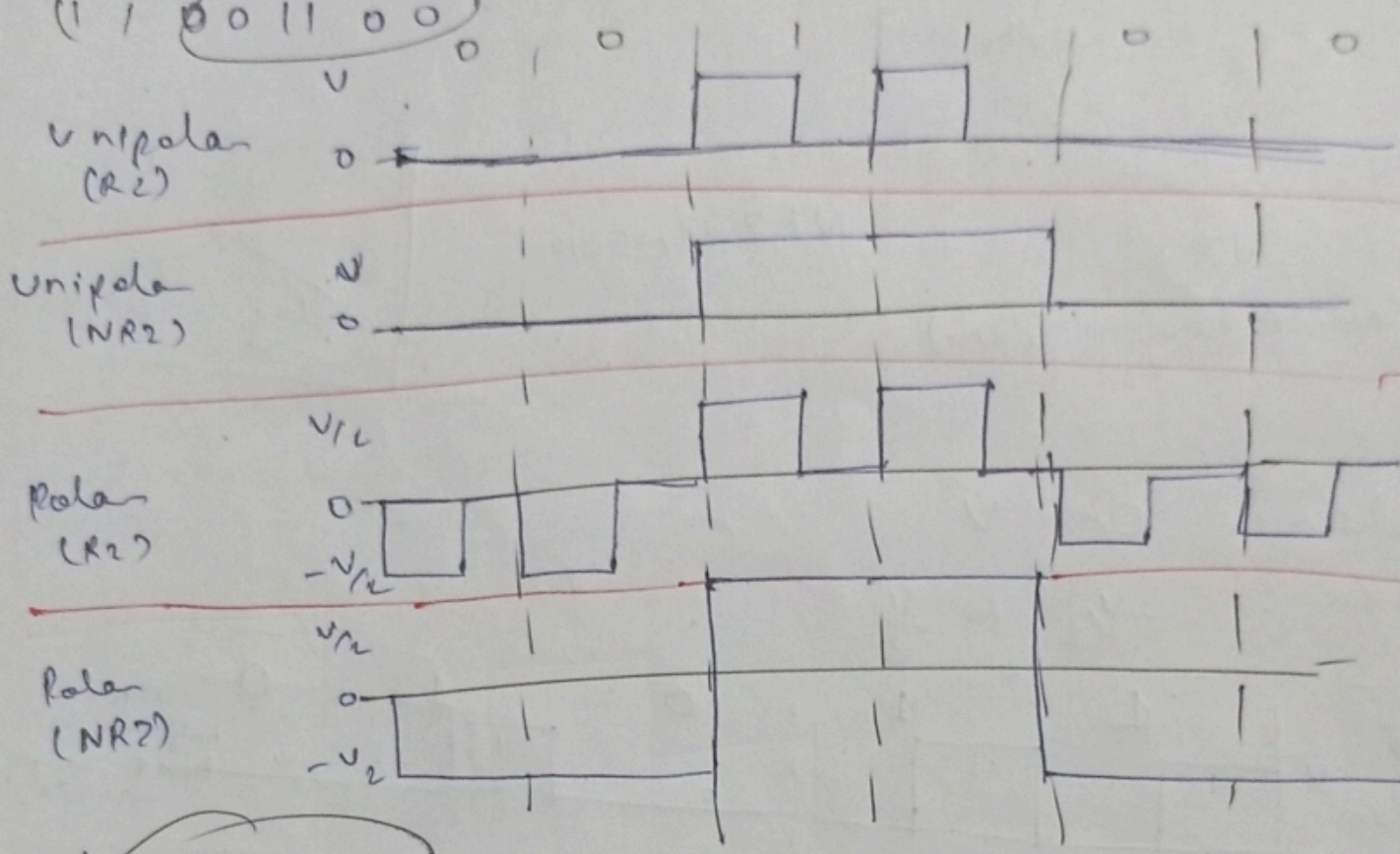


Q Represent the following in ① Polar (NRZ) ② Polar (RZ) ③ Unipolar (NRZ) ④ Unipolar (RZ)

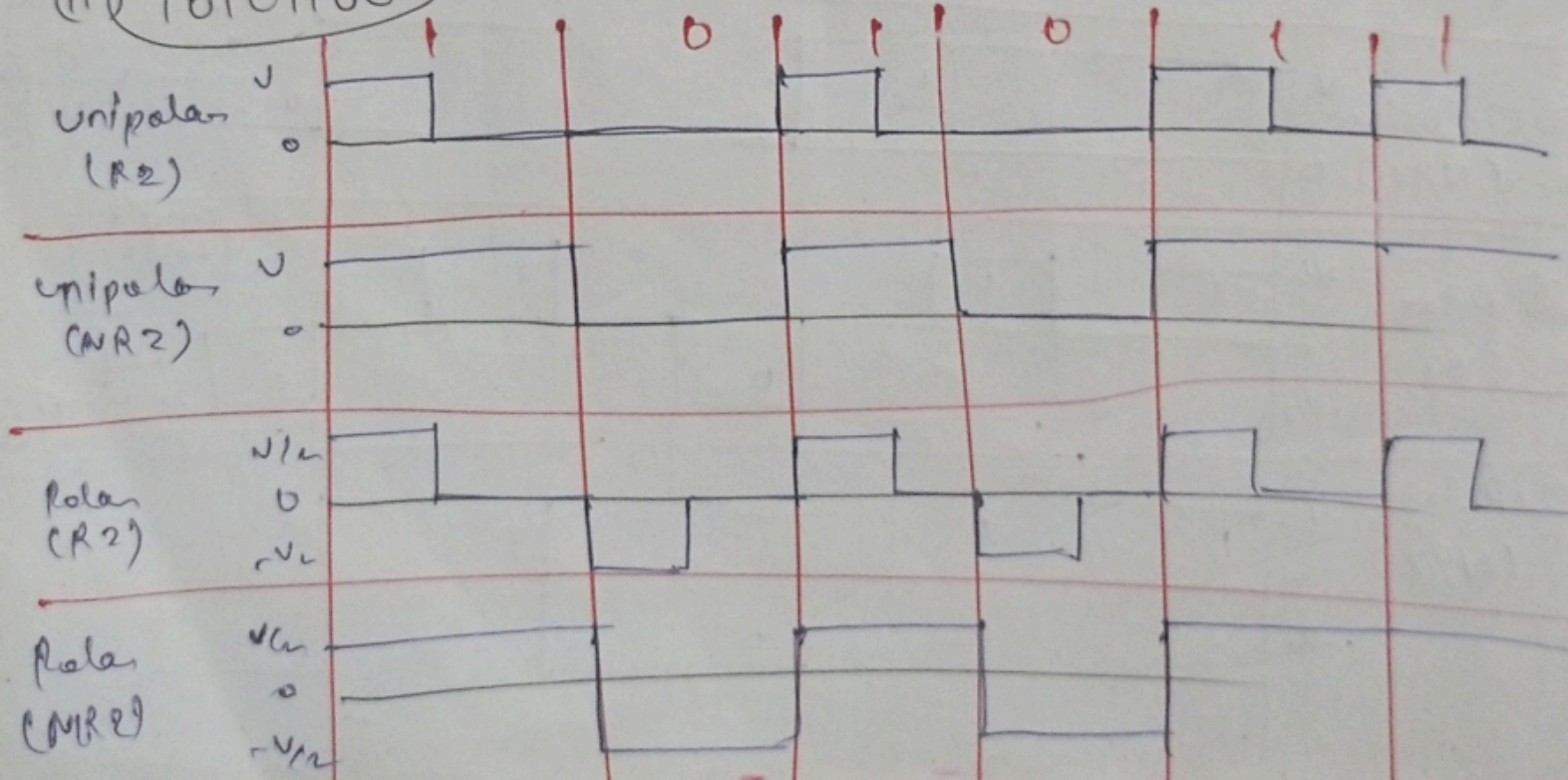
(i) 00|100 (ii) 10|011008

(iii) 011011

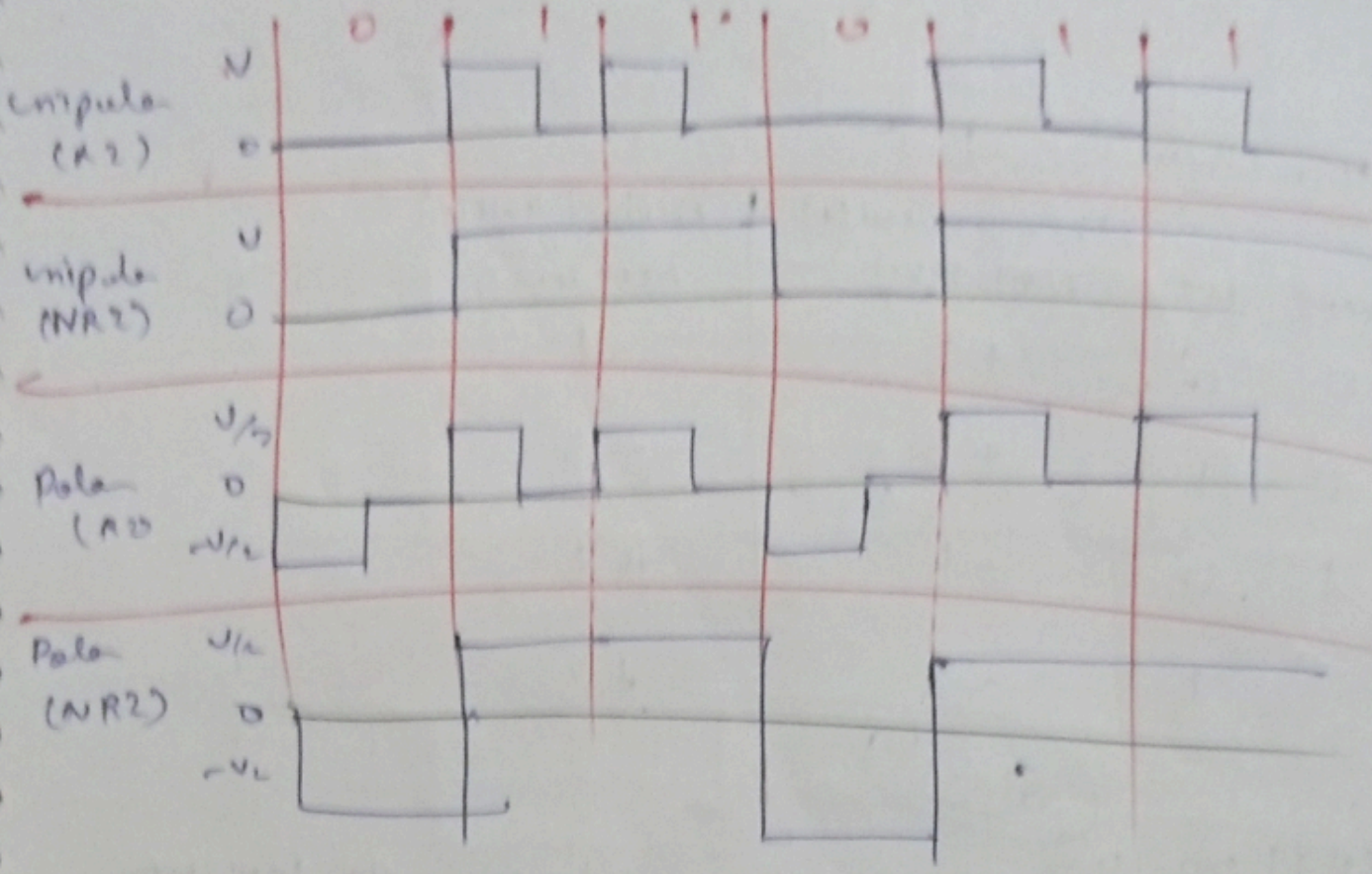
(i) 00110 0



(ii) 10101100



(iii) 01101


0 1 1 0 1
Unipolar (RZ)
V
0
Unipolar (NRZ)
V
0
Polar (RZ)
V/2
0
-V/2
Polar (NRZ)
V/2
0
-V/2

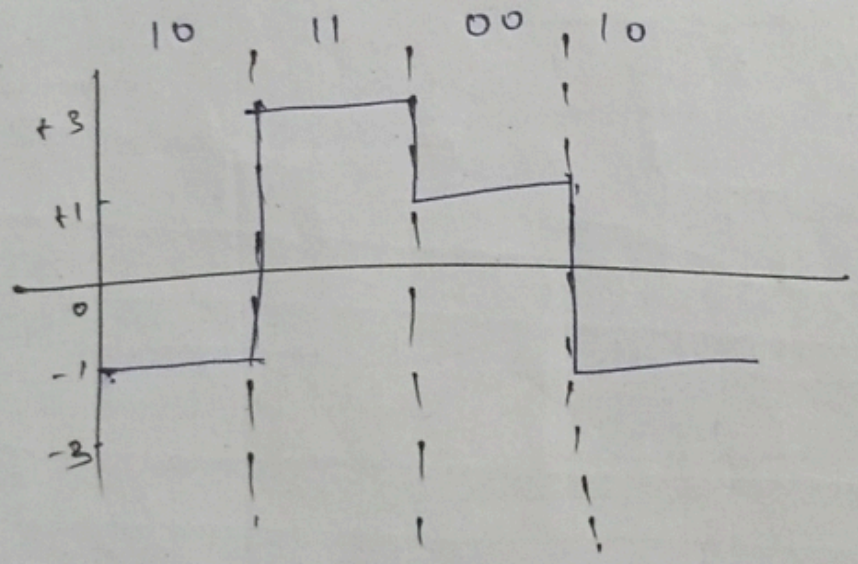
#Multilevel

Multilevel 2B Q

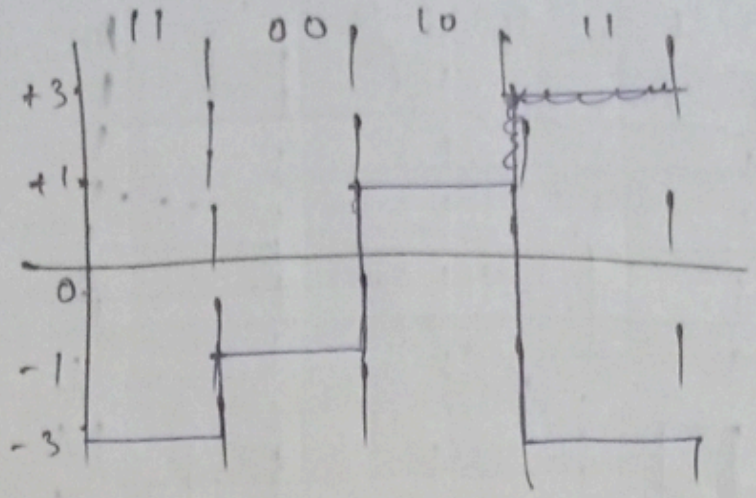
Next bit	Previous level (+) Next level	Previous level (-) Next level
0 0	+1	-1
0 1	+3	-3
1 0	-1	+1
1 1	-3	+3

Start

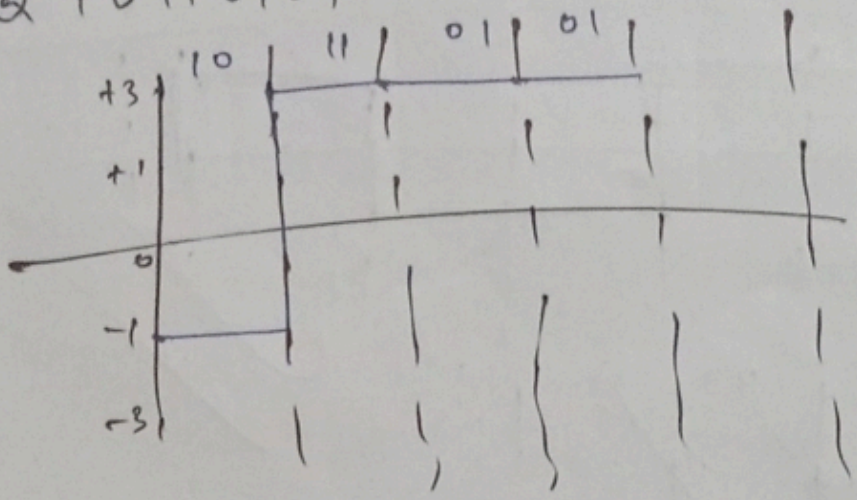
Q 10 11 00 10 make pair of two & found in the Next bit.

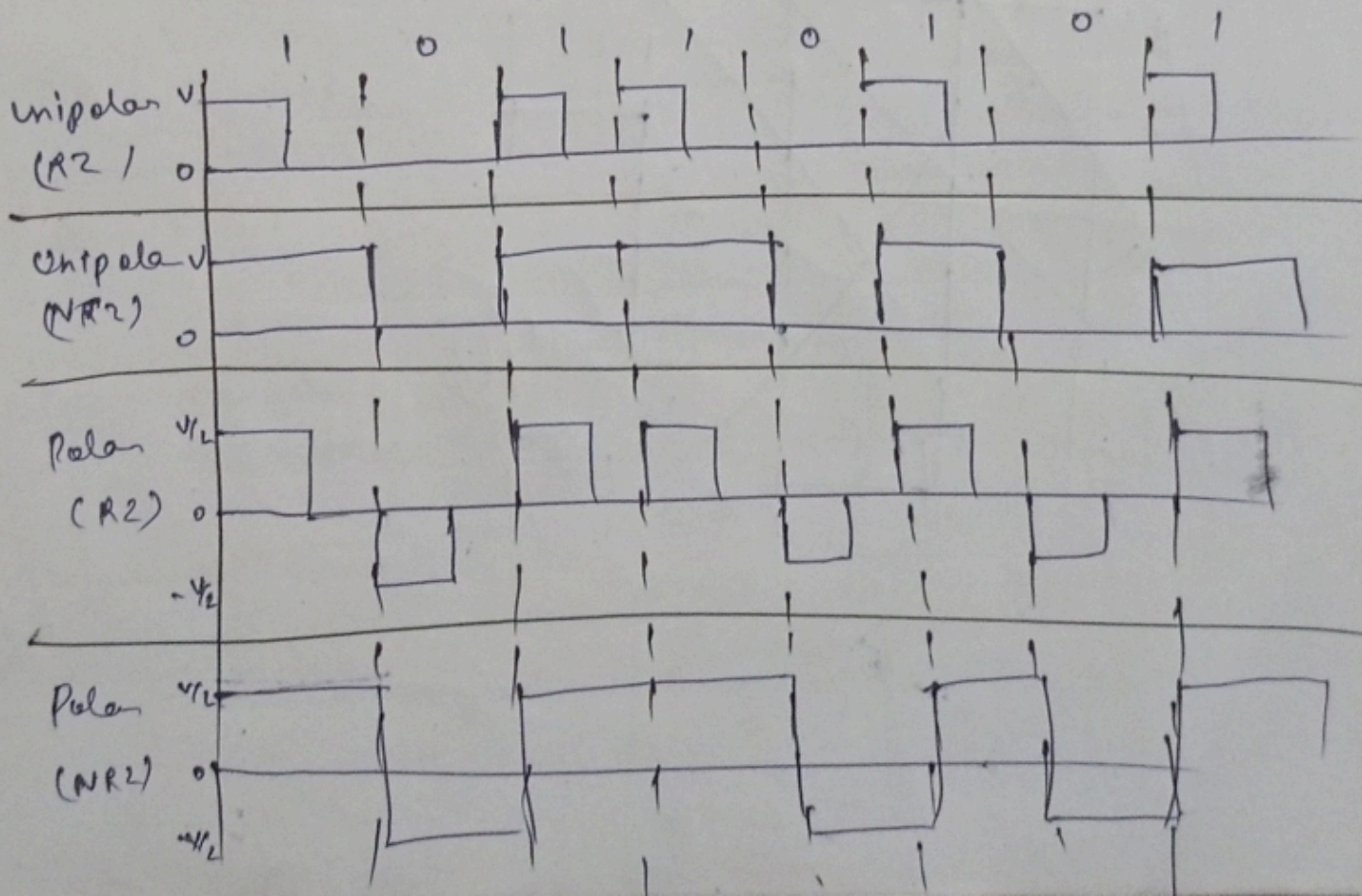


b) 11 00 10 11



c) 10 11 01 01





UNIT - 2

Data Link Layer :- Frame
Physical Layer :- Bits

responsibilities of Data Link Layer

Data-Link Layer

Kya karta hai Data Link layer / kya karta hai

① Node to Node connectivity (Hop to hop)

② Flow Control
- Stop & Wait
- Sliding Window
  - Go back N
  - Selective repeat

③ Error Control
- Error detection
- Error Detection + correction

④ Access Control
- ALOHA
- CSMA / CD

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⑤ Flow Control :-

ARQ => Automatic repeat request

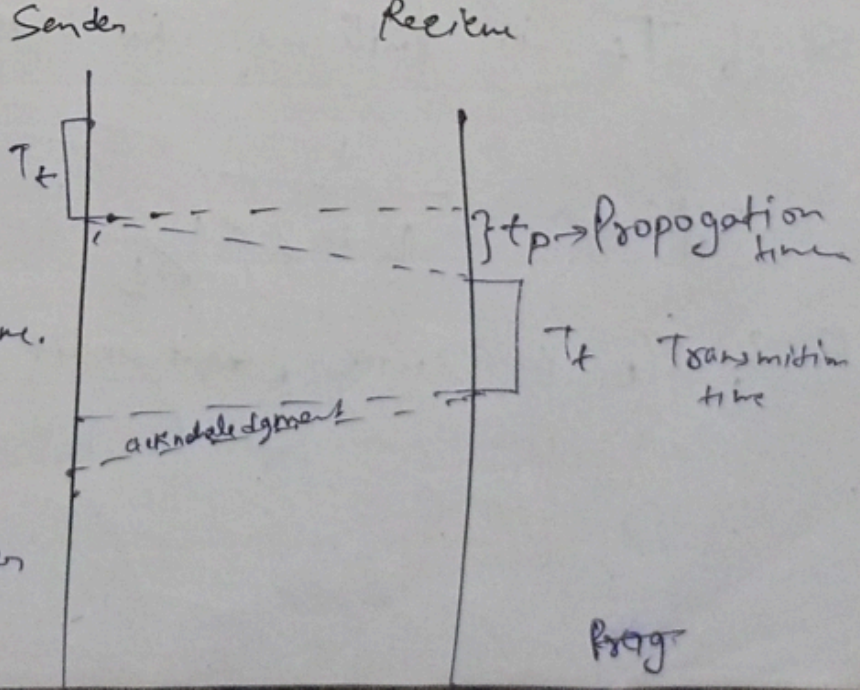
① Stop & Wait

T_t :- Transmition Time

The time taken by the packet / frame to get uploaded on the chanel is known as transmition time.

T_p :- Propogation Time

The time taken by the packet / frame to reach sender to reciever is known as propogation time.



Prog

⑧ Stop & Wait flow control technique

→ The sender send the packet / frame & wait until & unless it recieves the Acknowledgment of the packet which it has send.

→ Once the packet is recieved by the reciever it send the Acknowledgment of that packet to the sender.

→ Hence, Until & Unless the Acknowledgment of the first package is not recieved by the sender, it will not send the next package.

⑧ Efficiency = $\frac{\text{Useful time}}{\text{Total time}}$

⑧ Efficiency = $\frac{1}{1+2a}$; $a = \frac{T_p}{T_t}$

⑧ $T_t = \frac{L}{B}$ L → length of frame / packet
B → Bandwidth of frame / packet

⑧ $T_p = \frac{D}{V}$ D → Distance
V → velocity of frame

Q If T_t is 1 millisecond what will be efficiency.

Efficiency $\frac{1}{1+2\times 1/1} = \frac{1}{3} = 0.33\bar{}$

Q If T_t is 2 ms, T_p is 1 ms

=

~~Q 11~~

Q If the Bandwidth is 4mbps t_p is 1ms & what should be the length of the packet so that the efficiency is 50%

B = 4mbps → 4×10^3 bits $T_p = 1m$

$T_t = 2m$

$L = T_t \times B$

$= 2 \times 4 \times 10^3$

$= 8 \times 10^3$ bit

Throughput {Effective Bandwidth} = $\frac{L}{1+2a}$ · a, $\frac{T_p}{T_t}$

Effective Bandwidth = efficiency × Bandwidth.

If efficiency = 50%, & Bandwidth = 4mbps the what will be the effective bandwidth

$= 0.5 \times 4 \times 10^3$

$= 2 \times 10^3$

Through put :- No. of frames in the channel per unit time.

Stop & Wait

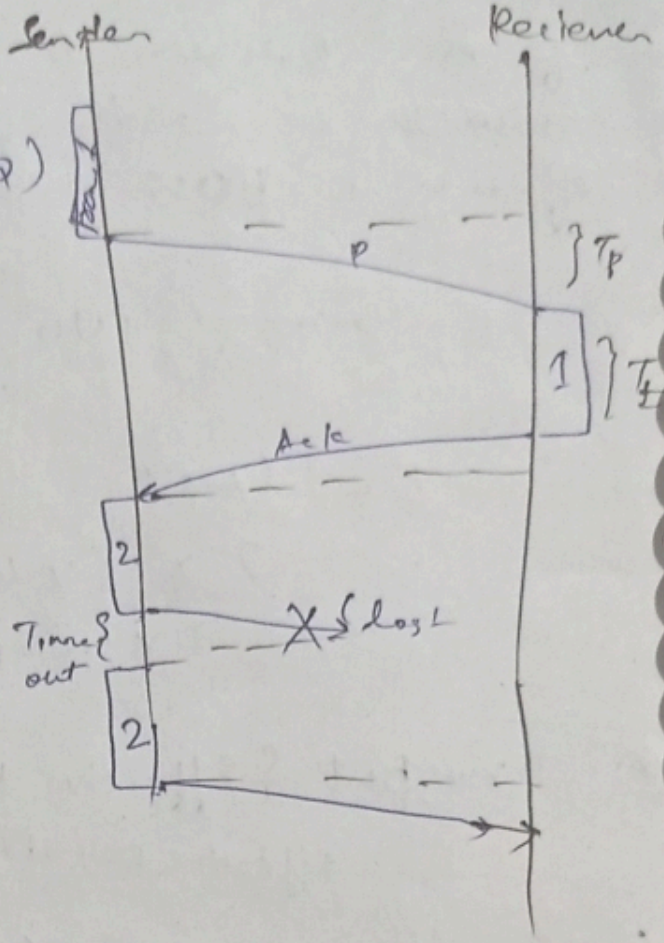
(Situation) 1 =

→ when data is lost (S&W ARQ)

→ ~~Efficiency is less~~

→ Time out ARQ

Apne se likhna hai !!!



Situation 2 —

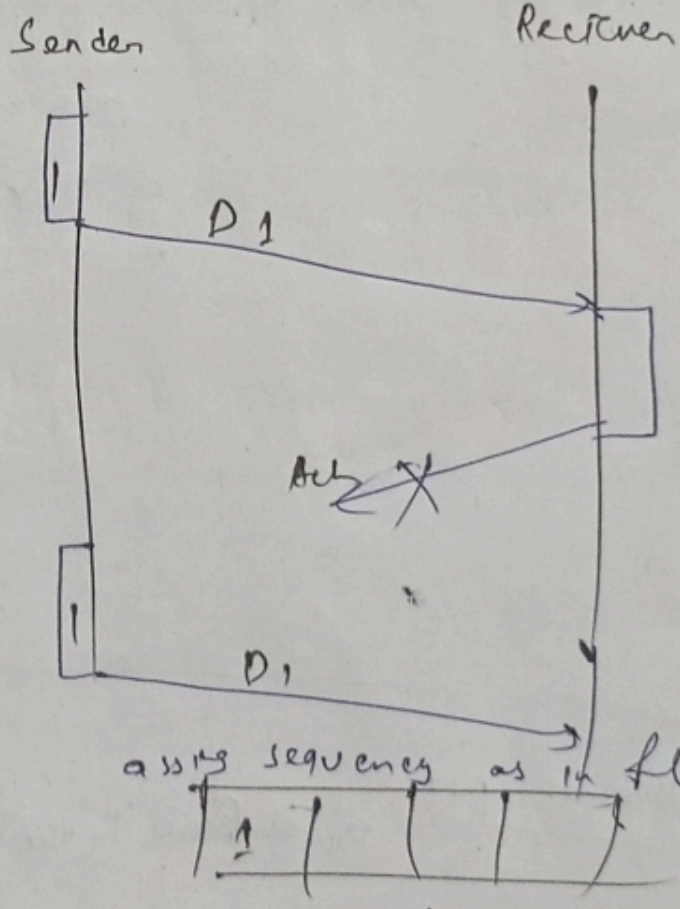
→ When Acknowledgment is lost

S&W + T.O + Seq. no.

↑

Time Out

Apne se likhna hai !!!



using sequence as in flag

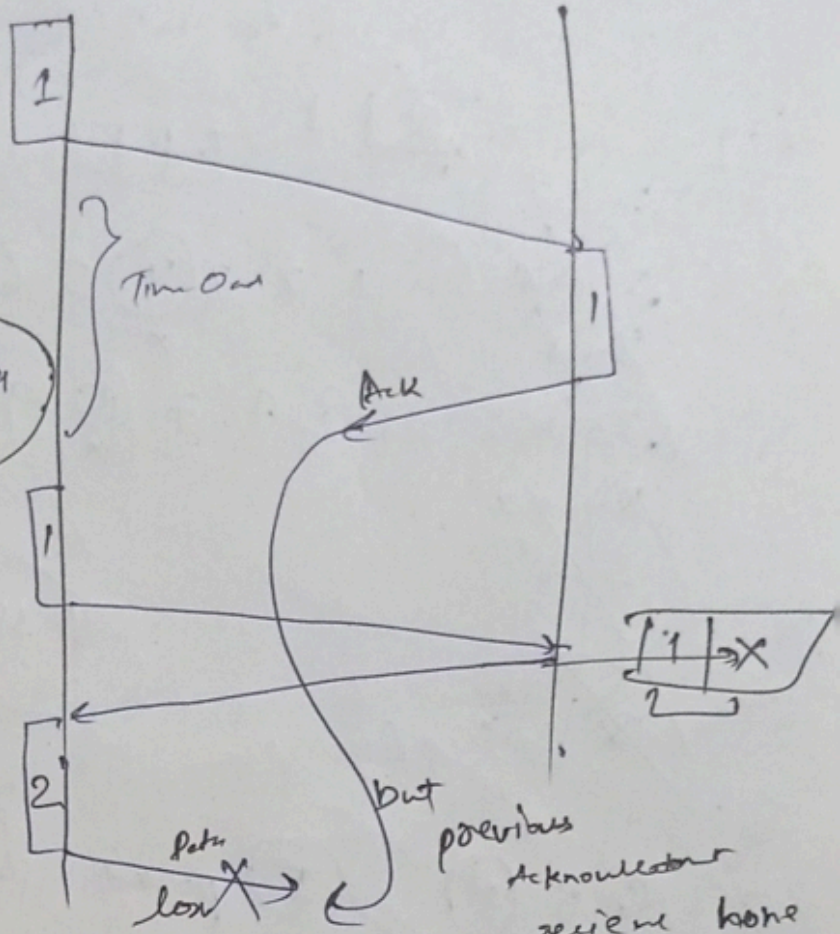
↑ sequence is repeat means duplicate in data

Situation 3:-

Delayed Acknowledgment

Sender

Receiver



Toh Acknowledge bo bhi sequence dedenge

SWQ + TO + ARQ + Seq of Data + Seq of Ack

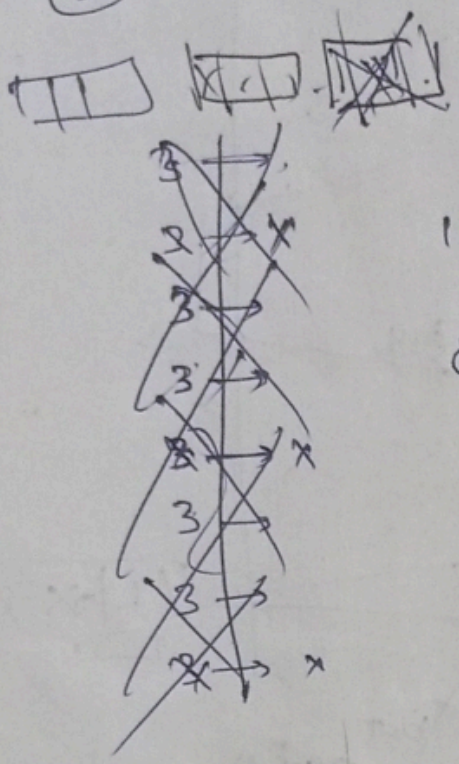
~~Tak Acknow~~

Q In a channel every fourth packet is lost if total 10 packet is have to be sent how many total transmission are needed in the channel.

(13)

1 2 3 X 4 5 6 X 7 8 9 10 ~~11 12~~

Q In a channel every 4th packet is lost in total we have 10 packet to be transmitted. with the help of Go Back 3 (3). Total no. of transmission



1 2 3 (4) 5 6 4 (5) 6 7 5 (6) 7 8 6 (7)

8 9 7 (8) 9 10 8 (9) 10 9 10.

Answer 27

Q2 GBN (4) (5) packet lost the 10 packet

1 2 3 4 (5) 6 7 8 5 (6) 7 8 9 10 (7) 8 9 10

7 (8) (9) 10 8 9 (10) 10

Answer → 26

1 2 3 4 5 6 7 8 9 10

1 2 3 4 (5) 6 7 8 5 (6) 7 8 6 7 (8) 9 7 8 9

(10) 7 8 9 10.

Q GB (3) Packet (10) (5) lost

1 2 3 4. (5) 6 7 5 (6) (7) 8 9 7 8. (9) 10 9 10

Answer :- 18

Q In selective repeat every 5 packet is lost total 13 packet have to be send what will be total transmission. ~~Buffer = (3)~~ Answer

1 2 3 4 5 5 6 7 8 9 9 10 11 12 13 13

Answer - 16

Q Total 20 packet 6 packet is lost buffer size is 5 solve this quest in GO B N & Stop & w.

Home-Work

Error Control

- Error Detection
- Error Detection / correction

① Single bit error :- Sender : 1 0 1 0 1
Reciever : 1 0 1 1 0 — Single bit error

② Burst error :- Sender : 1 0 1 0 1
Reciever : 1 0 0 1 0 — Burst size ②

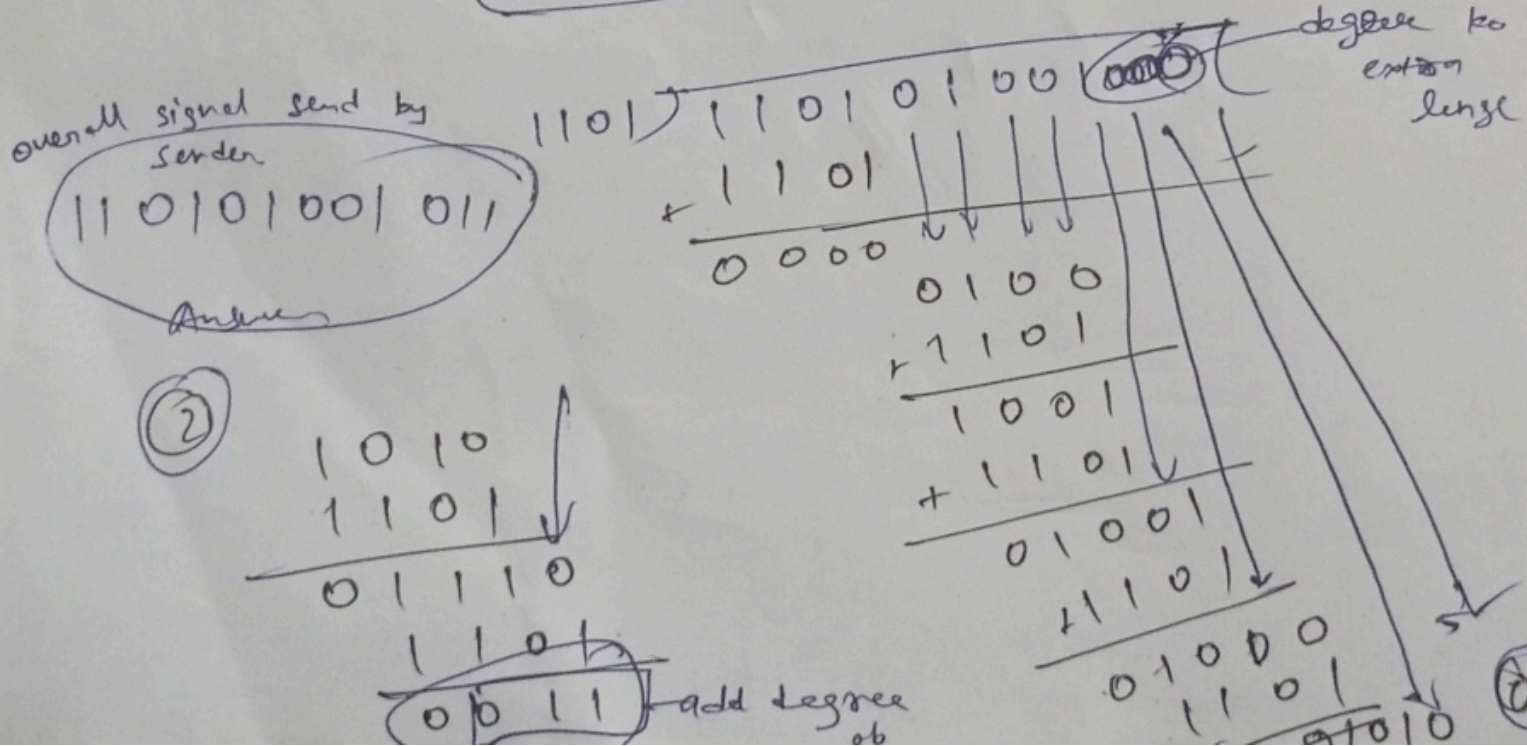
⇒ Single bit error :- when only One bit has change (even parity / odd parity)
→ We can detect single bit error using Parity bit

⇒ Burst error :- when more than one bit has change which is send by sender & recieve by reciever
→ We can detect burst error using
a. CRC (Cyclic Redendancy code)
b. Hamming code (for correction)

Q Sender 1101001, polynomial :- $x^3 + x^2 + 1$, Find the CRC code & the overall signal send by the sender.

$x^3 + x^2 + 1 = (1)^3 + (1)^2 + (0) + 1$

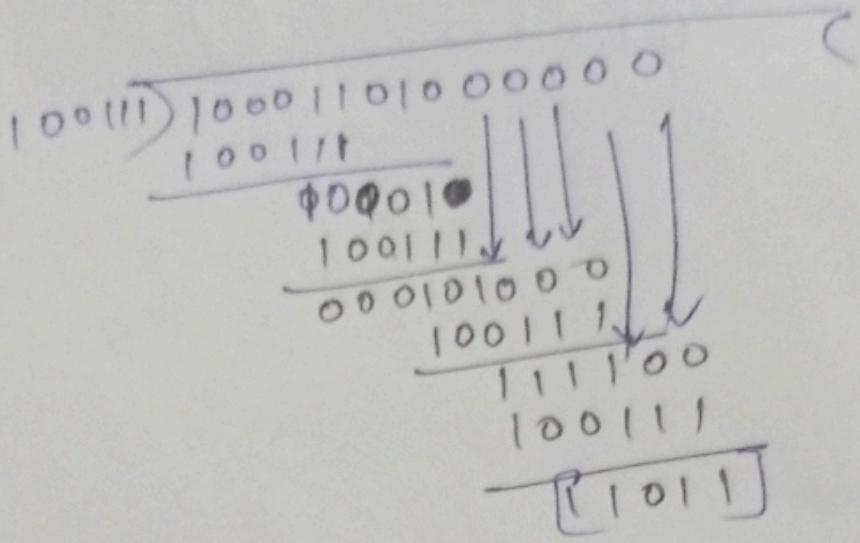
$= 1101$



Q Polynomial $-x^5+x^2+x+1$, Signal 10001010

CRC = ?

$x^5+0x^4+0x^3+0x^2+0x+1 = 100111$



CRC → 10001010 1011

Q what is Even parity & odd parity.

Homework