CN

Computer Networks

CO1:- Introduction.
[Uses, Network hardware, LAN's, Man's, Wan's internet works, Net. Software, protocol hierarchies, design issue for layers, connectionless oriented and connection services, OSI reference, etc]

CO2:- Physical Layer.
[Fourier analysis, bandwidth-limited signals, ISDN...]

CO3:- Data Link layer.
[Design - Issue, The medium access sublayer, Multiple access protocols - ALOHA, CSMA, etc., IEE standards 802 for LAN and MAN's, Tolken ring, etc]

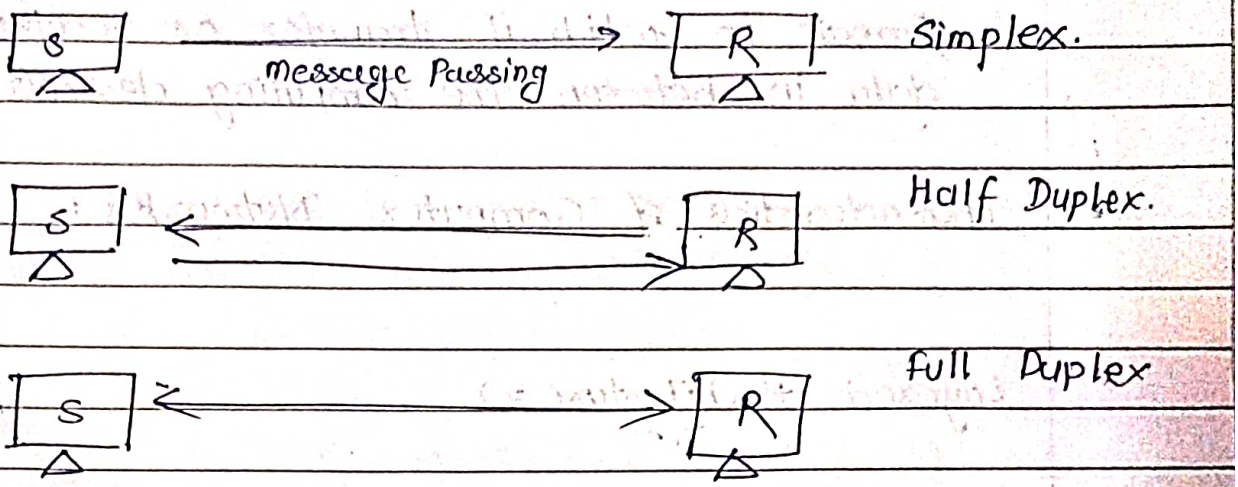
CO4 :- The network layer.

[Design issues, services provided to transport layer, internal organization, comparison of virtual circuits & datagram subnets, Optimality principle, routing algorithm, Routing, flooding, Prevention policies, IP protocols, etc]

CO5 :- Transport and application layer.

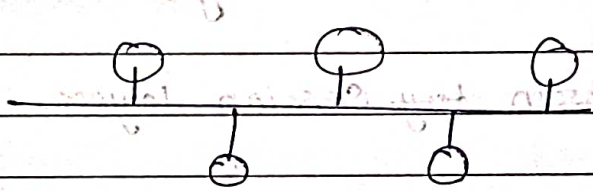
[Transport service primitives, Quality of service, elements of transport protocols, addressing, establishing a Connections, releasing a connection, flow control and buffering, multiplexing, crash recovery, etc.]

- Communication types =>

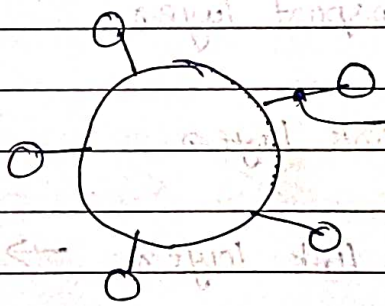


- ~~Tepelopi~~ Topologies =>

① Bus =>

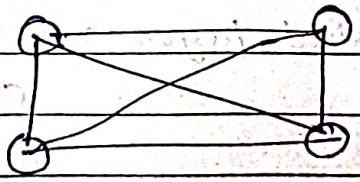


② Ring =>

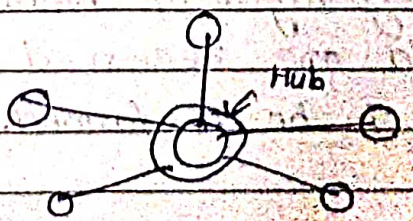


If tokens get matched then data can get transferred

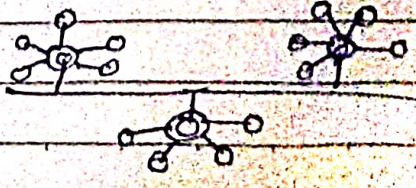
③ mesh =>



④ Stare =>



⑤ Hybrid =>



Binary code
ASCII code.

Page No.:
Date:
YOUVA

- Protocol :-
  The medium in which it follows the particular formate in which it transfer or receive the data in between the computing devices.

- Characteristics of Computer Networks :-

- Layered Architecture =>

  A Application layers.

  P Presentation layers.

  S ~~Sessoin~~ Session layers.

  T Transport layer

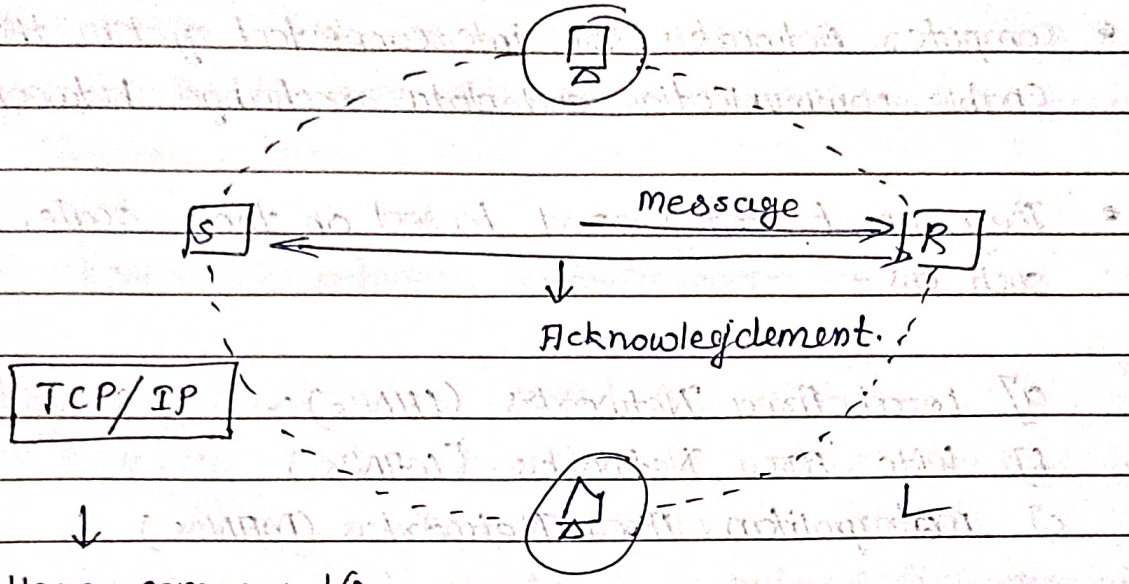
  N Network layers

  D Data link layers. →

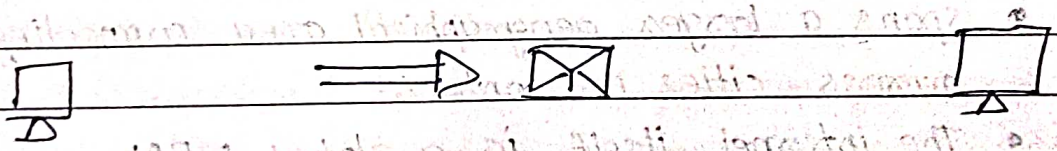
  P Physical layes → Hardware layes.
  (Wired computer network)

=> Each and every layes of Network have the its interface and are reserved for particular task or service to be performed.

Connection Oriented Service Primitive:-



=> TCP



=> UDP.

ⓐ Computer Networks :-

- Computer Networks are interconnected system that enable communication and data exchange between devices.
- They can be categorized based on their scale, such as -

a] Local Area Networks (LAN's) :-
b] Wide Area Networks (WAN's)
c] Metropolitan Area Networks (MAN's)

a] LANs :-

- Connects devices within a limited geographical area, like home, office or campus.

b] WANs :-

- Spans a larger geographical area, connecting LANs across cities or countries.
- The internet itself is a global WAN.

c] MANs :-

- Covers a larger geographical area than a LAN but is smaller than a WAN, typically within a city.

Computer Network Architecture :-

- Computer network architectures define how different components and layers are organized to enable communication.

- There are some common types -

a] Peer - to - Peer (P2P) architecture :-
  - All devices have equall status and can communicate directly with each other.
  - No central server is required for communication.

b] Client Server Architecture :-
  - Involves a central server that provides resources and services to client devices.
  - Clients request service, and servers fulfill these request.

c] Centralized Architecture :-
  - Centralized control and processing occur in a single location.
  - Typically found in smaller networks or organization

d] Distributed Architecture :-
  - Control and processing are distributed across multiple locations.
  - Offers better scalability and fault tolerance.

e] Hierarchical Architecture :-
  - Organized in multiple layers, each serving a specific purpose.
  - Comonly used in large networks for better management and scalability.

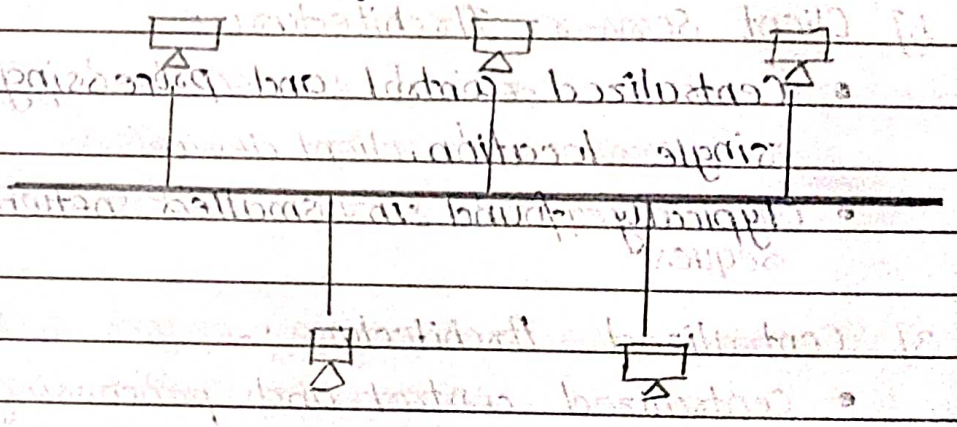
Topology :-

- Topology in computer networks refers to the physical or logical layout of interconnected devices and the way data is transmitted between them.

- There are some common topologies in C.N.:-

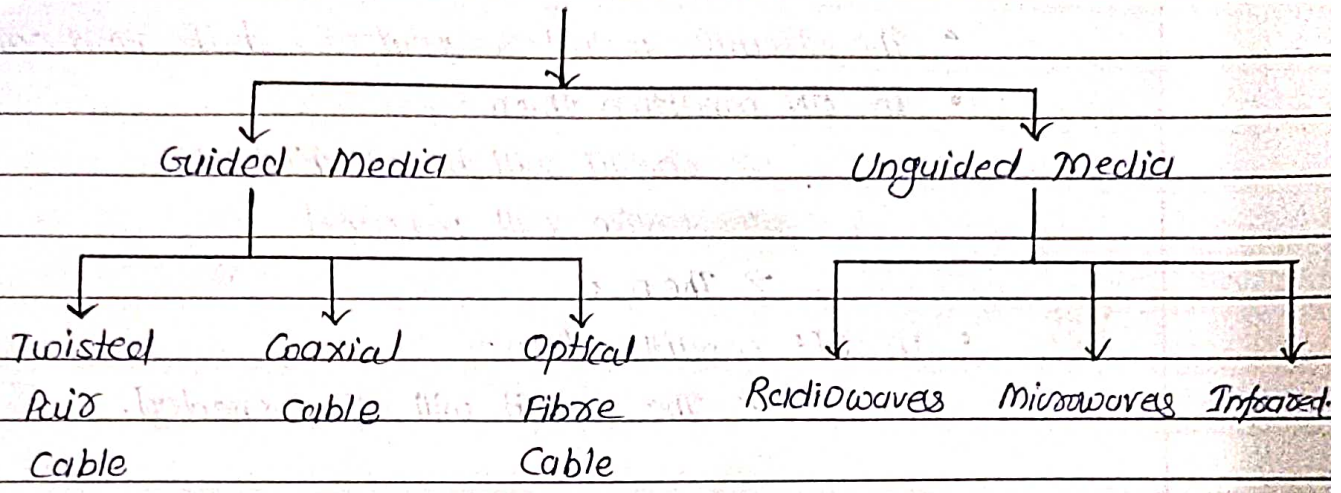
1] Bus topology :-

- Single central cable (bus) to which all devices are connected.
- Simple and cost-effective but can face performance issue with heavy traffic.

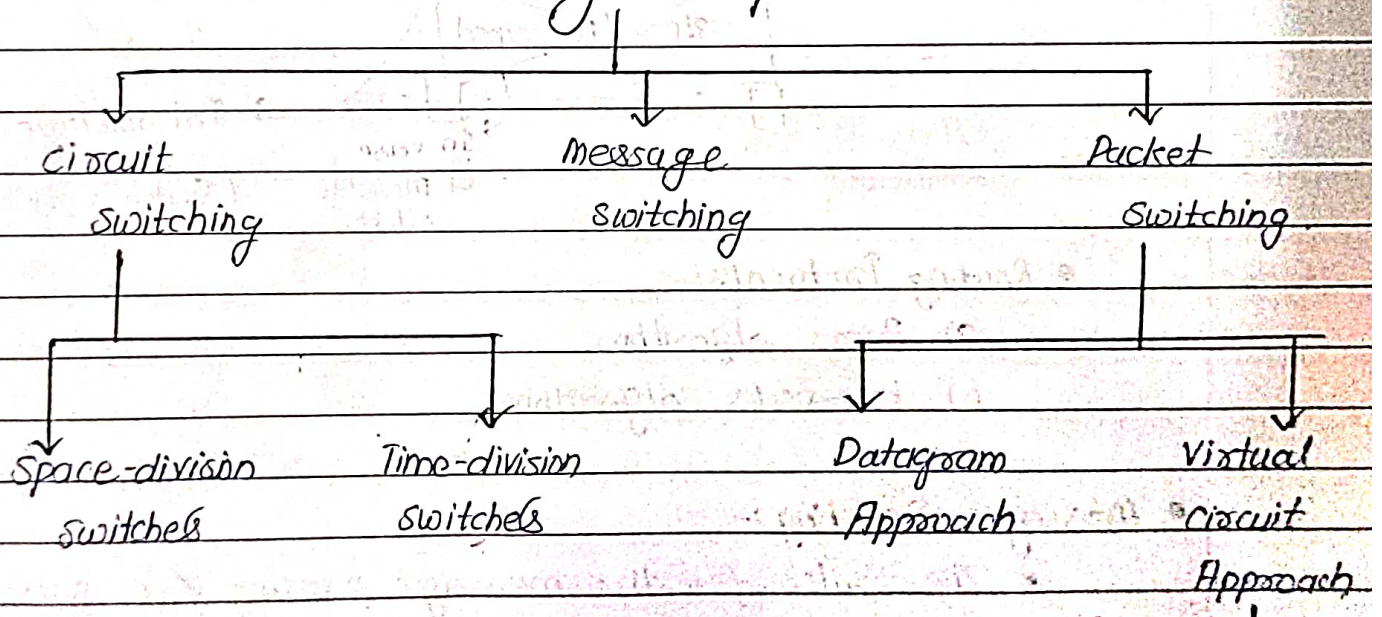


2] Ring Topology :-

Types of Transmission Media



Switching Technique



- Switching →

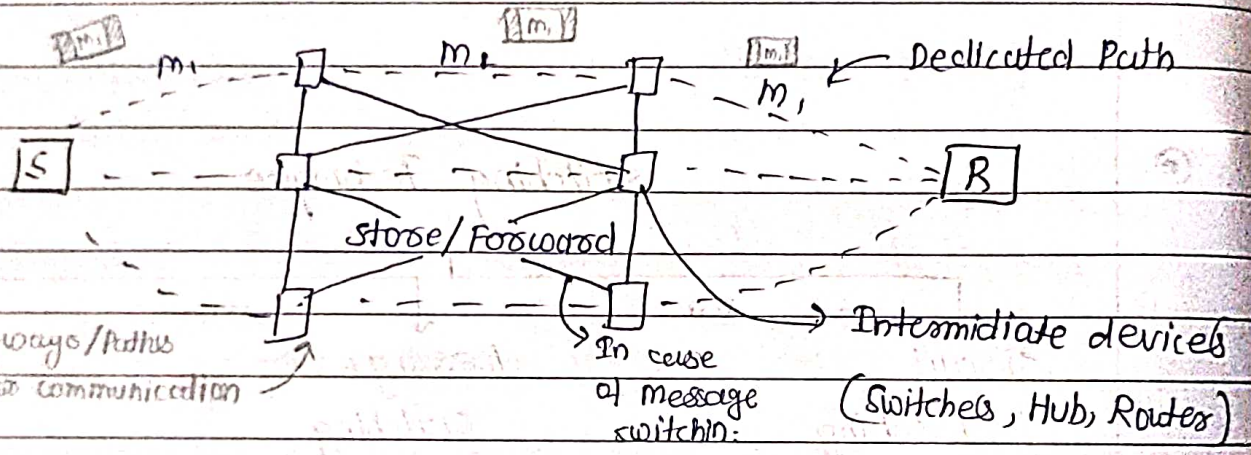
The dedicated way to data transferring and the data communiling break.

ON/OFF

Date:

- Circuit Switch:-
  - Limited range
  - Based on the physical / Hardware devices.
  - The circuits includes routers, hubs and cabling.
  - In ON condition then -
    - → circuit will be established
    - → service will proceed

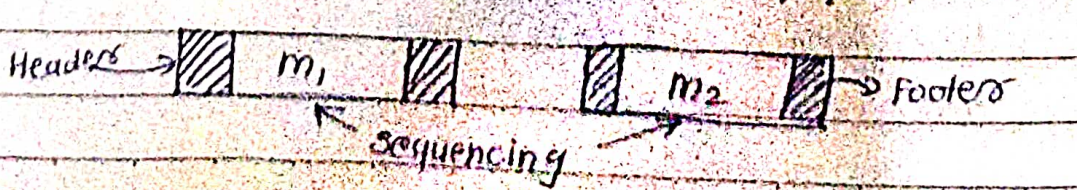
  - In OFF condition then -
    - → The circuit will dissconnected.



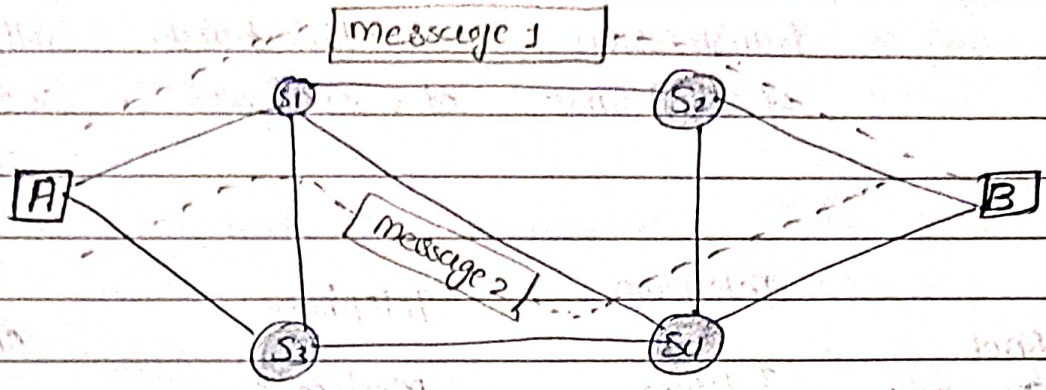
- Routing Protocals:-
  - a) Poim's algorithm
  - b) Kruskals algorithm

- Message Switching:-
  - The route for the message pussing from source to destination are choosen via the routing protocols.
  - It contains the static Routing technology.

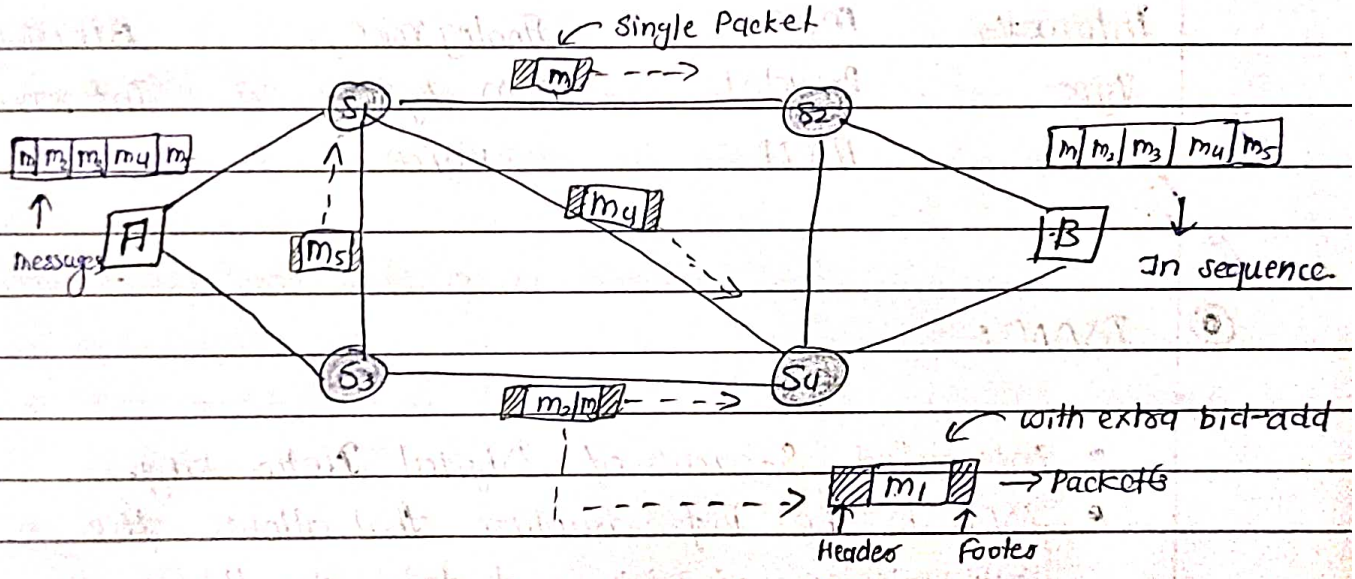
- Packet Switching:-
  - Messages are devided into form of packets.



- The add of extra bits.
- This includes dynamic Routing. -- (changes)
- The decision pathing most efficient & fast is preferred /chages first.



--- Diagram- message switching ---

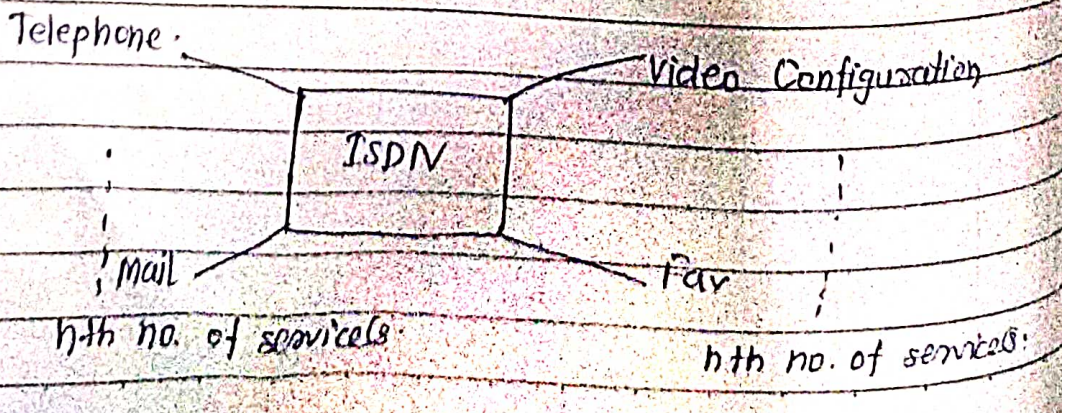


---pigram - Packet Switching ---

	Message Switching	Circuit Switching	Packet Switching
Application	Telegraph Network for transmission of telegrams.	Telephone network for bidirectional real-time transfer of voice signals.	Internet for datagrams and reliable stream service between computers.
End Terminal	Telegram Teletype	Telephone Modem	Computer.
Information Type	morse, Baudot ASCII	Analog voice, PCM digital voice	Binary Information.

(6) ISDN :-

- Integrated Services of Digital Networking.
- ISDN is the infrastructure that allows the transmission of voice and data simultaneously with greater efficiency.



- There are two types -

difference
- Narrowband ISDN
- Broadband ISDN

- Through single networking the multi-media transmission takes place within a same network.
- Intranet ---

◉ Data Rate :-

- Data rate → measured in Bit Rate
  - bps
  - kbps
  - mbps
  - Gbps
- No. of data is transmitted in each no. of seconds.
- Noiseless is an feature of 6GB.

- Maximum Data rate of a channel :-
  - Data rate refers to speed of data transfer through channel.
  - Computed in,
    ① bps - (bits per sec)

    Higher Data rates -

    ②

Date:

Nyquist Theorem :-

- The nyquist theorem provides a theoretical upper limit for the
- Noiseless.

Shannon Theorem :-

signal to noisele

C / Bit

Capacity / Bitrate = bandwidth * ($\log_2$ (1 + SNR))

Nyquist Theorem Based Questions -

- Question -

Consider a noiseless channel with Bw of 300 H_2 transmitting a signal with two signal levels. The max bit rate can can be calculated as -

Given ⇒ B = 300 H_2

$B.R. = 2B \log_2 L$

Bit rate = $2 \times 300 \times \log_2 2$

= 600 bps

- Question :-

Consider the same noiseless channel transmitting a signal with four signal levels (for each level we send 2 bits). The max bit rate can be calculated as -

---- $\log_2 4 = 2$

Nyquist Theorem :-

- The nyquist theorem provides a theoretical upper limit for the
- Noiseless.

Shannon Theorem :-

Signal to noiseless ratio

$$\text{Capacity / Bitrate} = \text{bandwidth} \times (\log_2 (1 + SNR))$$

Nyquist Theorem Based Questions -

- Question -

Consider a noiseless channel with BW of 300 H_2 transmitting a signal with two signal levels. The max bit rate can can be calculated as -

Given $\Rightarrow B = 300\ H_2$

$$B.R = 2B \log_2 L$$

$$\text{Bit rate} = 2 \times 300 \times \log_2 2$$

$$= 600 \text{ bps}$$

- Question :-

Consider the same noiseless channel transmitting a signal with four signal levels (for each level we send 2 bits). The max bit rate can be calculated as -

$$\log_2 4 = 2$$

Bit rate = $2 \times 300 \times \log_2 4$

$= 2 \times 300 \times 2$

$= 1200$ bps.

◉ Shannon Theorem Based Problems :-

• Question–

We can calculate the theoretical highest bit rate of a regular telephone line.

Ans:-

Here,

A telephone line normally has a bandwidth of 3000Hz. The SNR usually 3162 db.

For this channel the capacity is calculated as –

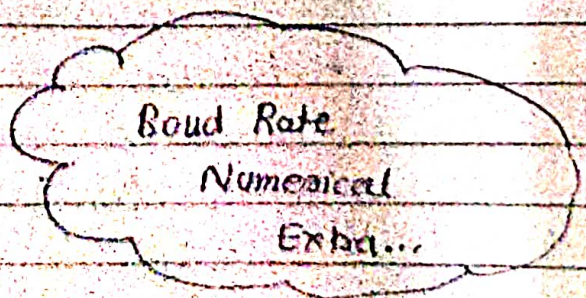
$C = B \log_2 (1 + SNR)$

$= 3000 \times \log_2 (1 + 3162)$

$= 3000 \times \log_2 (3163)$

$= 3000 \times 11.62$

$C = 34,860$ bps



• UNIT-03 •

Data Link Layers

- Data link layers -

⇒ Error controll
⇒ flow controll
⇒ The data is in form of frames.
⇒ frames
⇒ contains header and footer.
⇒ Detection of collision.

◉ Data link Layers :-

- It is the 2nd layers after physical layers.
- The data link layers is responsible for maintaining the data link between two hosts and nodes.
- Data link - layers divided into two layers -

a] Logical Link Controll sub-layers (LLC) :-

- Provides the logic for the data link.
- It controlls ① synchronization,
② flow control
③ error checking
functions of the data link layers.
- Functions are -
a) Error recovery
b) Controlls flow controll operations.
c) Users Addressing.

b] Media Access Control Sub-layer :- (MAC)

- Second sub-layer of data-link layer.
- It controlls flow and multiplexing for transmission medium.
- Transmission of data packets is controlled by this layer.
- This link layer functions are -
  a) To perform the control of access to media
  b) Performs unique addressing to stations directly connected to LAN.
  c) Detection of Error

⊙ Design - Issues -

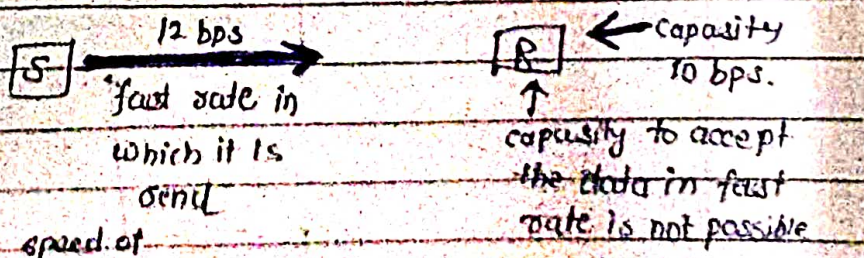
a] Services provided to the network layer :-

b] Frame Synchronization :-

↳ To perform parallel processing...
↳ ~~It delays time limit.~~

c] Flow Control :-

↳



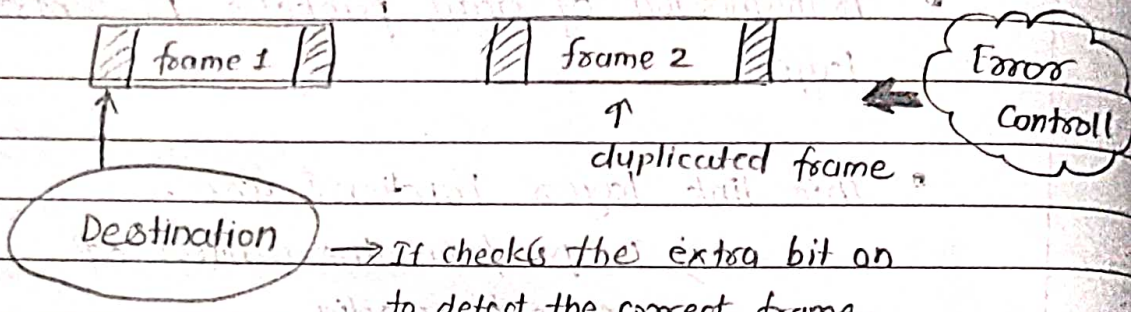
speed of

↳ Here both must be synchronized to accept data

↳ This is an most big issue.

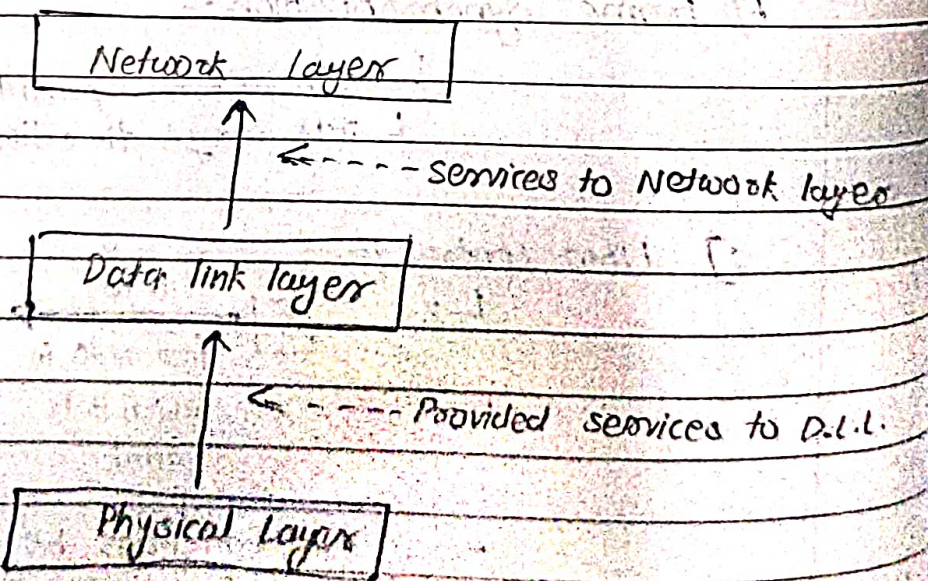
d] Error Controll :-

- To prevent the duplication of frame.
- The errors introduced during transmission from S to R machines must be detected and corrected at the destination machine.



e] Services to the Network layer :-

- Each layer uses the services of the layer below it and provides services to the layer above it.
- The data link layer uses



- Services provided can be of three types -

a] Unacknowledged connectionless services.

b] Acknowledged conectionless - services. ---> Bank acknowledges each transaction

c] Acknowledged. connection- oriented services ---> wired network

◉ Framing :-

- Data link layer receives raw bit stream from the data of physical layer that may be not error free.

- To ensure a reliable transfer of bit stream with error free to the network layer by breaking them into frames.

◉ Flow Control

- Characteristics of Flow control -

1] Character Count

2] Flag bytes with byte suffering

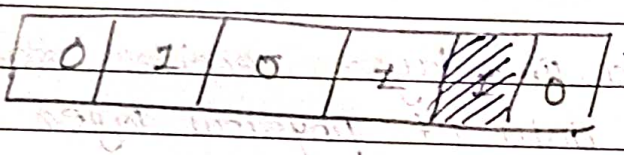
3]

Error Detection :-

- It is collection of methods involving coding which are used to detect errors in transmitted and stored data to correct them.

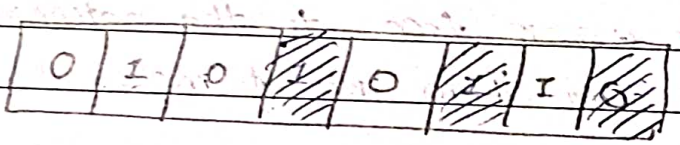
- Types of Errors -

a] Single Bit Error :-



← Single Bit change.

b] Burst Error :-



→ More than 1 bit change (burst error occurs)

- Error detection methods -

ⓐ Single Parity -

① m+1 bit (m=no. of message bits)

② Even Parity (even no. of 1's)

• Example —

① 14 → Bits of message
Generator → is polynomial ⇒ $x3 + x + 1$

Answer :-

Now,

- The polynomial is written in binary as the coefficients

$$(1x^3 + 0x^2 + 1x + 1) \quad \text{---> 4 nodes} = n$$

- Start with the message to be encoded:

1101001110110

- Now, we have $4 = m$ so we append 3 zeros to LSB side.

---> 1101001110110000

- Now divide it by 1011

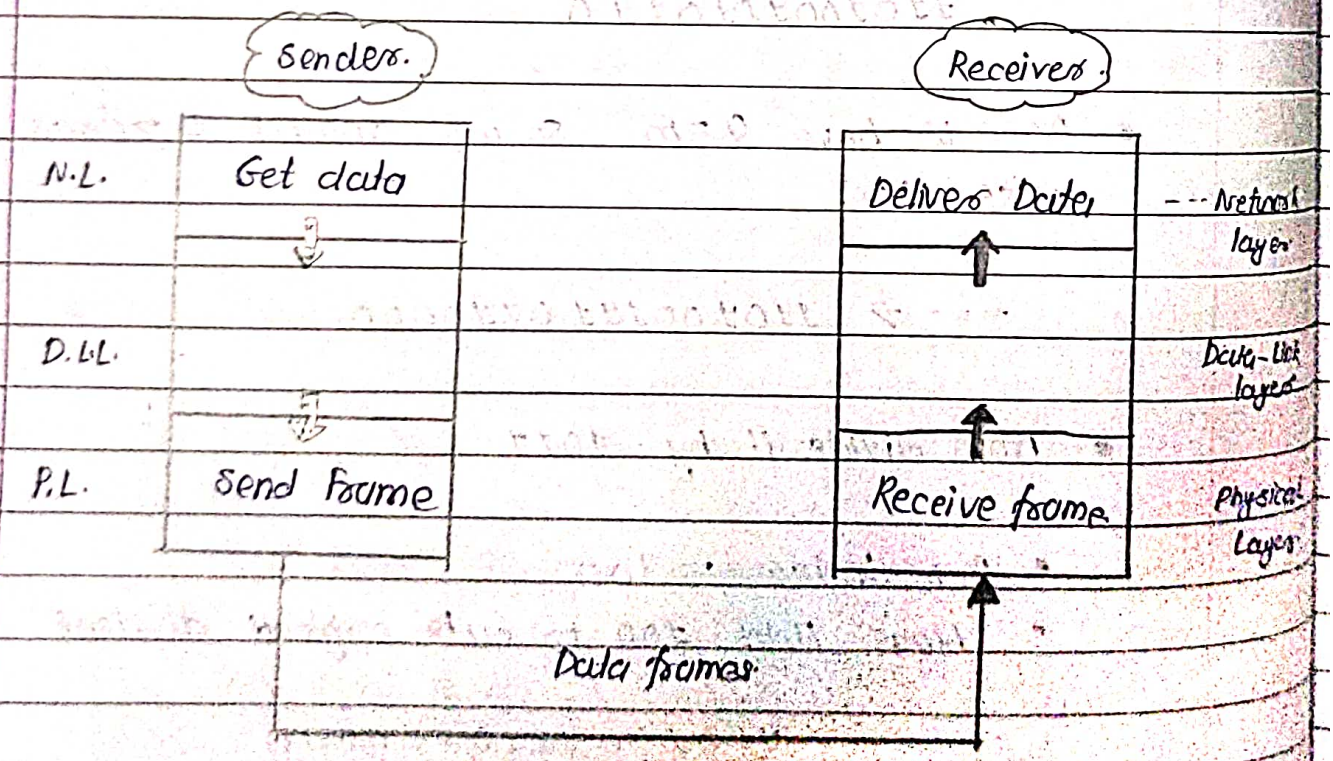
  - Remainder = 100
  - Now Add 100 to our original divident.

$$\begin{array}{r} 1101001110110000 \\ + \quad\quad\quad\quad\quad\quad 100 \\ \hline 1101001110110100 \end{array}$$

① Data Link Protocols :-

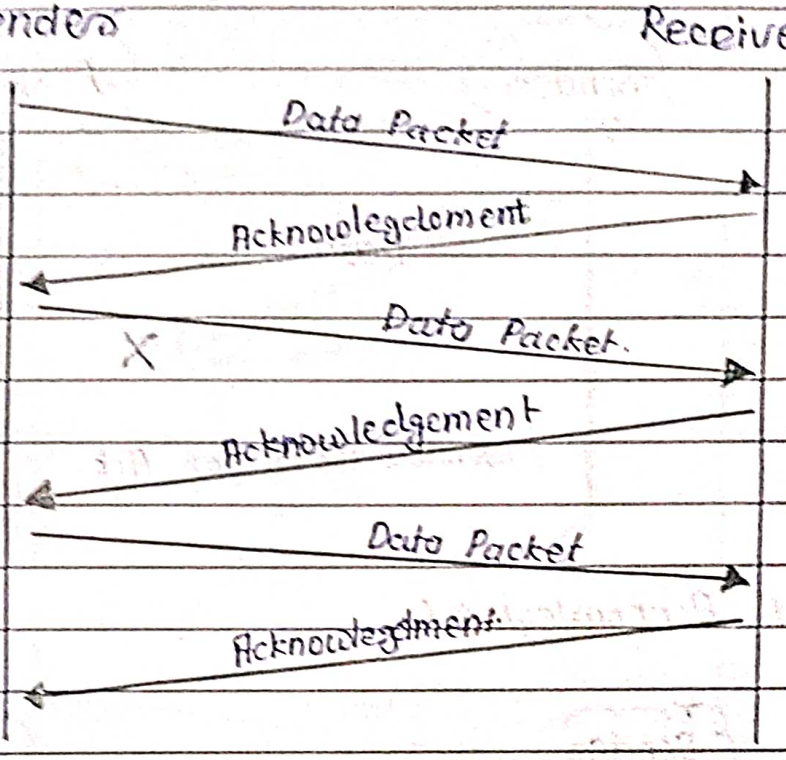
- Data link Protocols
  - For Noiseless Channel
    - → Simplex
    - → Stop-and-Wait
  - for Noisy Channels
    - → Stop-&-Wait ARQ
    - → Go-Back-N ARQ
    - → Selective Repeat ARQ

② Simplex Protocol :-



Dij : Simplex Protocol

• Working of Stop and Wait Protocol :-



Dig: Stop and Wait Protocol.

⊙ Noisy Channels :-

① Stop-and-wait Automatic Repeat Request

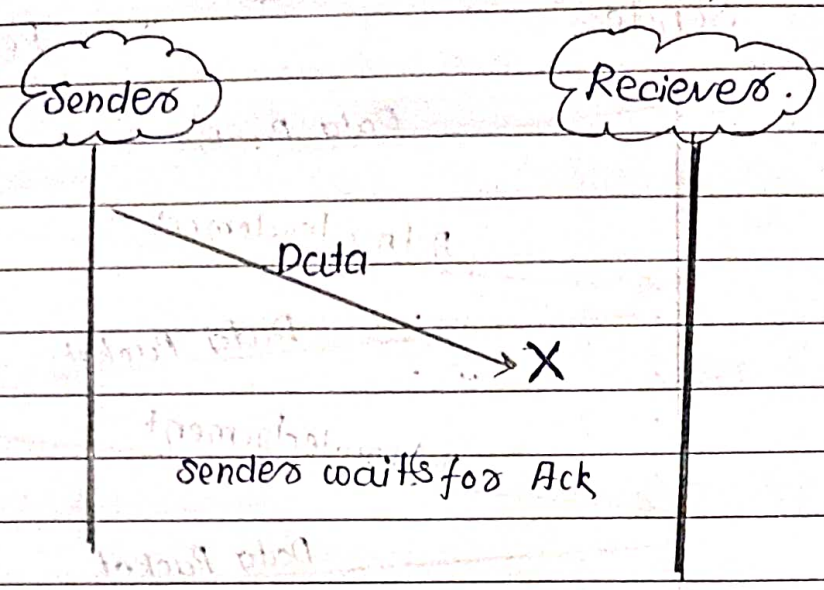
② Go-back-N ARQ

③ Selective Repeat ARQ

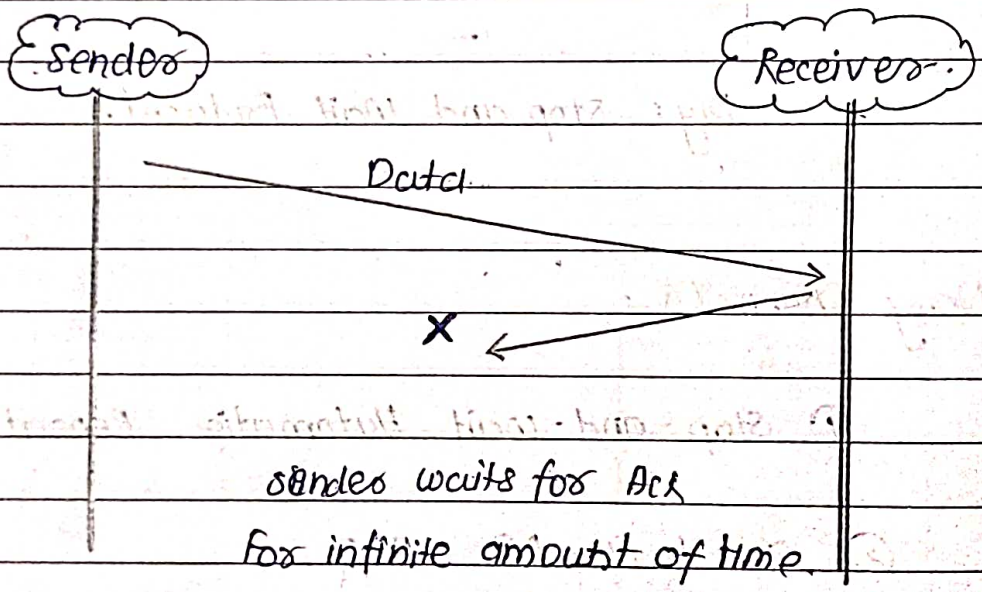
Date: YOUVA

Problems in Data link Protocol:-

1] Lost Data -

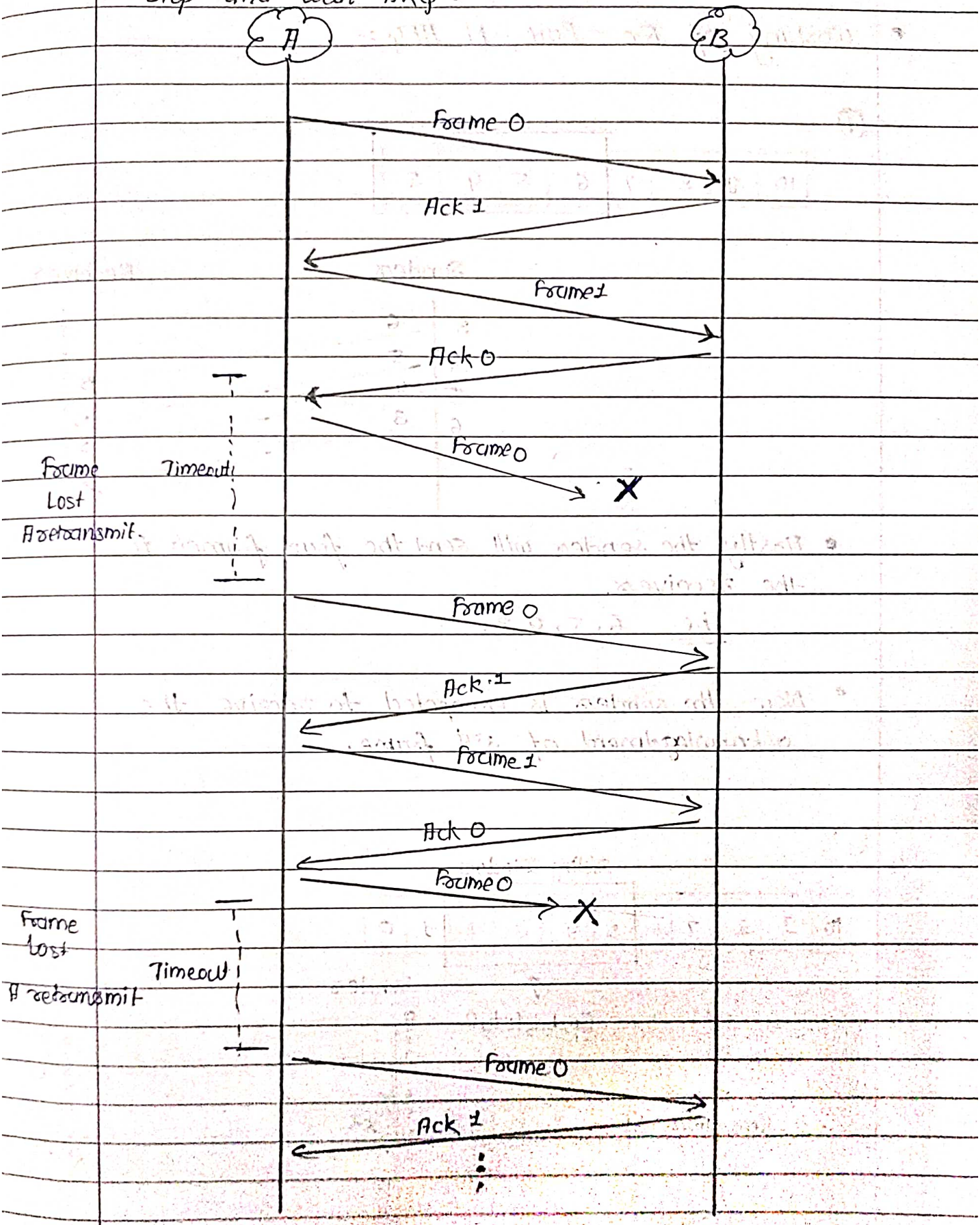


2] Lost Acknowlegment.



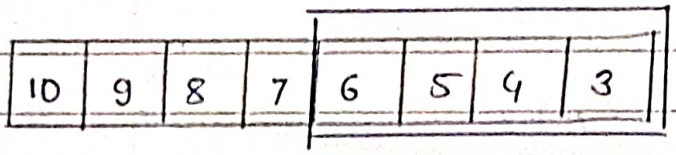
3] Delayed Acknowledgement of Data:-

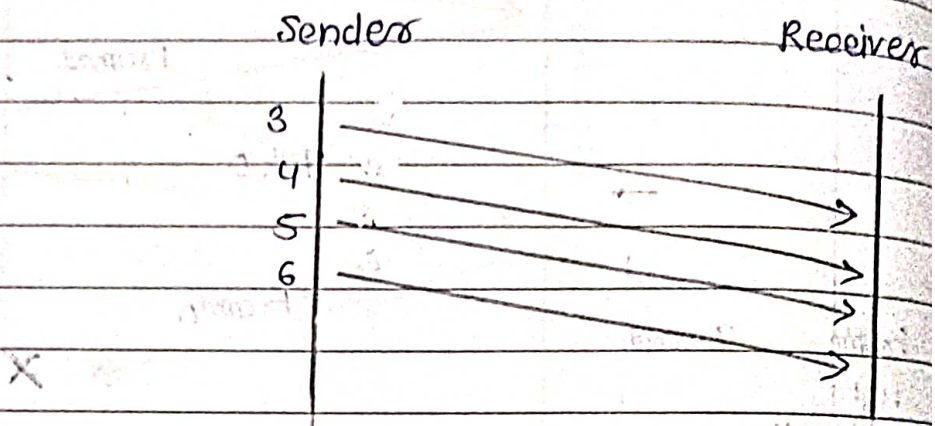
- Stop-and-wait ARQ :-



- Working of Go - Back - N ARQ :-

(1)

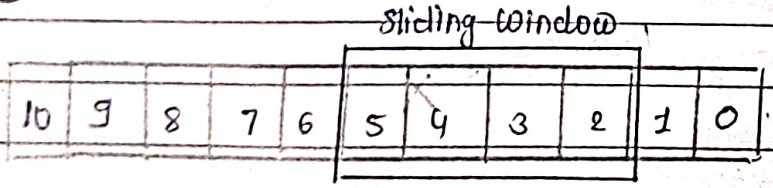




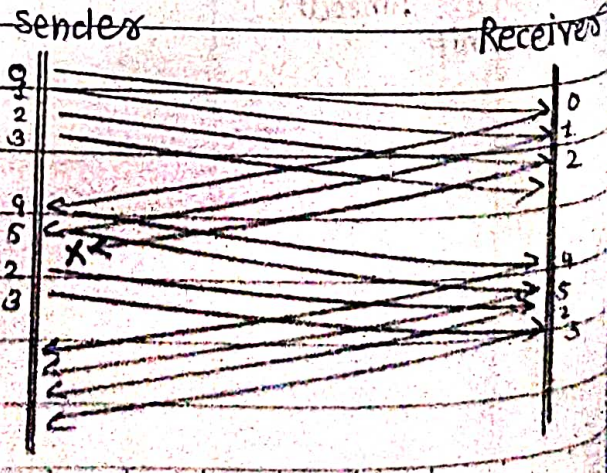
- Firstly the senders will send the four frames to the receivers.
  i.e. 6, 5, 4, 3.

- Now the senders is excepcted to receive the acknowlegdment of 3rd frame.

(2)



Go-back to 2



Time limit - 4