Chapter: Unit = 1

1) For what purposes you would use Simplex Transmission? Half Duplex Transmission? Full Duplex Transmission.

-> These three transmission modes are used in diff" communication scenarios based on the requirements for data flow:

* Simplex Transmission.

-> I would use simplex transmission when:

- Only one-way communication is needed.
- The receiver never needs to respond back on the same channel.
- Broadcasting information to multiple receivers.
- Simplex hardware requirements.

Examples:

- Radio or TV broadcasting.
- Loudspeaker announcements.
- Computer to printer communication.

* Half Duplex Transmission.

-> I would use half duplex transmission when:

- Two-way communication is needed, but not simultaneously.
- Taking turns communicating is acceptable.
- Channel bandwidth needs to be conserved.
- Often implemented with buffers to store data while waiting to transmit.

Examples:-

- Walkie-talkies or two way radios.
- Early internet chat system.

* Full Duplex Transmission.
→ I would use full-duplex transmission when:
- Simultaneous two-way communication is required.
- Real-time interaction is important.
- Minimal communication delay is critical.
- Typically has higher bandwidth requirements than half-duplex.

Examples.
- Telephone conversations.
- Video conferencing.
- Modern Internet connections.
- Online gaming with voice chat.

In conclusion, If you think of communication as a road, simplex is a one-way street, half duplex is a single-lane road where traffic alternates directions, and full duplex is a two lane highway with traffic flowing in both direction simultaneously.

2. Which transmission mode will have higher speed and why?
→ When comparing transmission speeds of the three modes:

- Full Duplex Offers the highest Effective Speed.

Full duplex transmission generally provides the highest effective speed because:

1. Simultaneous data flow.
→ Both devices can transmit and receive at the same time without waiting, eliminating idle time.

2. No turnaround time.
→ Unlike half-duplex, there's no delay for switching betⁿ trasmitting and receiving modes.

3. Continuous transmission.
→ Data flows continuously in both directions without interruption.

4. Efficient acknowledgments.
→ Receipt confirmations can be sent immediately while receiving data, reducing wait times for verification.

5. Better throughput.
→ For the same bandwidth allocation, full duplex effectively doubles the usable communication capacity compared to half-duplex.

6. Reduced latency.
→ Interactive applications benefit from immediate responses without transmission ~~gaps~~ gaps.

In real world implementations like Ethernet networks, a 100 Mbps full-duplex connection can simultaneously transmit 100 Mbps in each direction (effectively 200 Mbps total throughput), while a half-duplex connection could be limited to 100 Mbps shared between both directions, with only one direction active at any moment.

Simplex is limited to 1-way comm only, making it efficient for its specific purpose but unable to match full-duplex's bidirectional capabilities.

3. Which transmission mode will incur more cost & complexity? Give reasons.
→ Full Duplex has the highest cost & complexity. Full duplex transmission typically incurs the most cost & complexity among these transmission modes for these reasons:

1. Dual Communication Channels.
→ Full duplex requires two complete sets of transmission/reception circuits or channels that can operate simultaneously, essentially doubling hardware requirements.

2. Signal Isolation.
→ When using a single medium, sophisticated circuitry is needed to separate incoming from outgoing signals to prevent interference (echo cancellation).

3. More Complex Hardware.
→ Network interface cards, switches, and routers supporting full-duplex need more complex chipsets & electronics.

4. Additional Bandwidth Requirements.
→ Often required more spectrum allocation or sophisticated multiplexing techniques to support simultaneous bidirectional communication.

5. Buffer Management.
→ Requires more complex buffer management system to handle simultaneous inbound & outbound

data streams.

6. Error Handling.
→ More sophisticated error detection & correction mechanism are needed to handle collisions & interference betⁿ transmitting & receiving signals.

7. Protocal Complexity.
→ Communication protocals must support simultaneous transmission and reception, adding complexity to the software stack.

8. Power Consumption.
→ Typically consumes more power as both transmitting and receiving circuits are active simultaneously.

By comparision, half-duplex systems are simple with only one circuit that switches between transmitting & receiving, while simplex systems are the simplest & least expensive with only unidirectional capability.