

# Computer Networks & Data Communication (4361101) - Summer 2024

## Solution

Milav Dabgar

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### Question 1(a) [3 marks]

List the different Network Topologies and discuss any one in detail.

#### Solution

Topology	Description
<b>Star</b>	All devices connected to central hub/switch
<b>Ring</b>	Devices connected in circular fashion
<b>Bus</b>	All devices connected to single cable
<b>Mesh</b>	Every device connected to every other device
<b>Tree</b>	Hierarchical structure with root node
<b>Hybrid</b>	Combination of two or more topologies

**Table 1.** Network Topologies

#### Star Topology Details:

- **Central Hub:** All nodes connect to one central device
- **Point-to-Point:** Each connection is dedicated between node and hub
- **Easy Management:** Simple to install and troubleshoot

#### Mnemonic

“STAR = Single Terminal All Reach”

### Question 1(b) [4 marks]

Explain how point-to-point and broadcast transmission technologies are used in modern communication systems with examples of real-world applications and discuss their advantages and limitations.

**Solution**

Technology	Point-to-Point	Broadcast
<b>Connection</b>	Direct link between two devices	One-to-many communication
<b>Example</b>	Telephone, VPN tunnels	Radio, TV, WiFi
<b>Data Flow</b>	Bidirectional	Unidirectional/Multidirectional

**Table 2.** Transmission Technologies Comparison**Point-to-Point Applications:**

- **Dedicated Lines:** Leased lines between offices
- **Satellite Links:** Ground station to satellite communication
- **Cable Modems:** Home to ISP connection

**Broadcast Applications:**

- **WiFi Networks:** Router broadcasts to multiple devices
- **Television:** One transmitter to many receivers

**Mnemonic**

“P2P = Private Path, Broadcast = Big Audience”

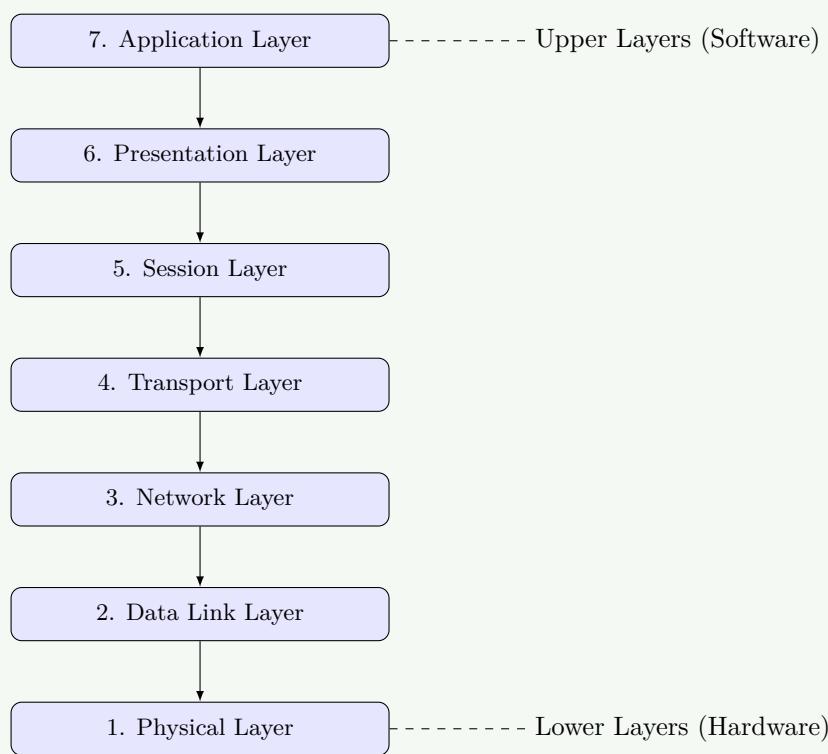
**Question 1(c) [7 marks]**

Describe OSI model with function of all layers.

**Solution**

Layer	Name	Function
7	Application	User interface, network services
6	Presentation	Data encryption, compression, formatting
5	Session	Establishes, manages, terminates sessions
4	Transport	Reliable data transfer, error correction
3	Network	Routing, logical addressing (IP)
2	Data Link	Frame formatting, error detection
1	Physical	Bit transmission, electrical signals

**Table 3.** OSI Model Layers

**Figure 1.** OSI Model Stack**Key Functions:**

- **Upper Layers (5-7):** Handle application-related services
- **Lower Layers (1-4):** Handle data transmission and routing
- **Encapsulation:** Each layer adds its own header

**Mnemonic**

“All People Seem To Need Data Processing”

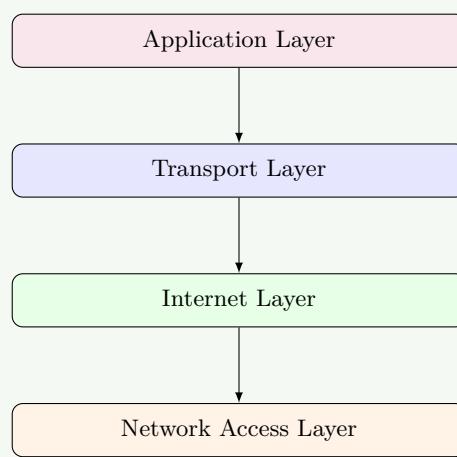
**Question 1(c OR) [7 marks]**

**Write a functional description of all layer of TCP/IP model.**

**Solution**

Layer	Name	Function	Protocols
4	Application	User services, applications	HTTP, FTP, SMTP, DNS
3	Transport	End-to-end communication	TCP, UDP
2	Internet	Routing, logical addressing	IP, ICMP, ARP
1	Network Access	Physical transmission	Ethernet, WiFi

**Table 4.** TCP/IP Model Layers

**Figure 2.** TCP/IP Model Stack**Layer Functions:**

- **Application:** Provides network services to applications
- **Transport:** Ensures reliable or unreliable delivery
- **Internet:** Routes packets across networks using IP addresses
- **Network Access:** Handles physical transmission media

**Mnemonic**

“Applications Transport Internet Networks”

**Question 2(a) [3 marks]**

**Describe Function of firewall in network security.**

**Solution****Firewall Functions:**

- **Packet Filtering:** Controls incoming and outgoing network traffic
- **Access Control:** Blocks unauthorized access attempts
- **Traffic Monitoring:** Logs and analyzes network activity

**Types:**

- **Hardware Firewall:** Physical device protecting entire network
- **Software Firewall:** Program installed on individual computers
- **Stateful Inspection:** Tracks connection states and contexts

**Mnemonic**

“Firewall = Filter, Access, Monitor”

**Question 2(b) [4 marks]**

**Compare FDDI (Fiber Distributed Data Interface) and CDDI (Copper Distributed Data Interface) in terms of their key characteristics, advantages, and applications.**

## Solution

Feature	FDDI	CDDI
<b>Medium</b>	Optical fiber	Twisted pair copper
<b>Speed</b>	100 Mbps	100 Mbps
<b>Distance</b>	Up to 200 km	Up to 100 meters
<b>Cost</b>	Higher	Lower
<b>Security</b>	Higher (difficult to tap)	Lower (easier to tap)
<b>Installation</b>	Complex	Simple

Table 5. FDDI vs CDDI Comparison

### FDDI Advantages:

- Long Distance:** Supports campus-wide networks
- High Security:** Immune to electromagnetic interference
- Reliability:** Better error detection and recovery

### CDDI Advantages:

- Cost Effective:** Uses existing copper infrastructure
- Easy Installation:** Standard twisted pair cabling
- Compatibility:** Works with existing network equipment

## Mnemonic

“FDDI = Fiber Distance, CDDI = Copper Cost”

## Question 2(c) [7 marks]

Explain and distinguish Ethernet, Fast Ethernet, Gigabit Ethernet.

## Solution

Type	Speed	Standard	Cable Type	Distance
<b>Ethernet</b>	10 Mbps	802.3	Coax/UTP	100m
<b>Fast Ethernet</b>	100 Mbps	802.3u	UTP Cat5	100m
<b>Gigabit Ethernet</b>	1000 Mbps	802.3z/ab	Cat5e/6, Fiber	100m/5km

Table 6. Ethernet Evolution Comparison



Figure 3. Evolution of Ethernet Standards

### Key Differences:

- Speed Evolution:** 10x increase at each generation
- Media Support:** From coax to twisted pair to fiber
- Applications:** LAN backbone, server connections, desktop
- Backward Compatibility:** Newer standards support older devices

### Standards:

- **10Base-T:** 10 Mbps over twisted pair
- **100Base-TX:** 100 Mbps over Category 5 UTP
- **1000Base-T:** 1 Gbps over Category 5e/6 UTP

#### Mnemonic

“Every Fast Gigabit = 10, 100, 1000”

## Question 2(a OR) [3 marks]

Explain its role and function of router within a network infrastructure.

#### Solution

##### Router Functions:

- **Packet Forwarding:** Routes data packets between different networks
- **Path Determination:** Selects best route using routing tables
- **Network Isolation:** Separates broadcast domains

##### Key Roles:

- **Inter-network Communication:** Connects LANs to WANs
- **Traffic Management:** Controls data flow between networks
- **Protocol Translation:** Converts between different network protocols

#### Mnemonic

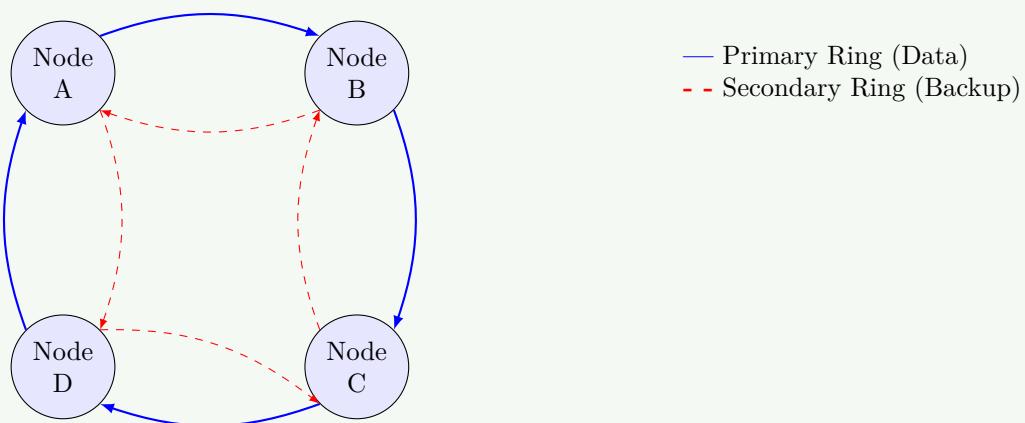
“Router = Route, Isolate, Connect”

## Question 2(b OR) [4 marks]

Explain the structure of FDDI (Fiber Distributed Data Interface) and give its advantages.

#### Solution

##### FDDI Structure:



**Figure 4.** FDDI Dual Ring Structure

**Note:** The above diagram is a simplified representation. In reality, FDDI uses two counter-rotating rings.

##### Components:

- **Dual Ring:** Primary and secondary rings for redundancy

- **Token Passing:** Uses token for media access control
  - **Concentrators:** Connect multiple stations to ring
- Advantages:**
- **High Reliability:** Dual ring provides fault tolerance
  - **Fast Speed:** 100 Mbps data transmission rate
  - **Long Distance:** Supports up to 200 km ring circumference
  - **Self-Healing:** Automatic reconfiguration when link fails

### Mnemonic

“FDDI = Fast, Dual, Distance, Immune”

## Question 2(c OR) [7 marks]

Explain roll of network Devices. Describe in brief about all the devices.

### Solution

Device	Layer	Function
<b>Repeater</b>	Physical	Regenerates signals, extends distance
<b>Hub</b>	Physical	Connects multiple devices, shared bandwidth
<b>Bridge</b>	Data Link	Connects LANs, reduces collisions
<b>Switch</b>	Data Link	Intelligent hub, dedicated bandwidth
<b>Router</b>	Network	Connects different networks, routing
<b>Gateway</b>	All Layers	Protocol conversion, network interconnection

Table 7. Network Devices Summary

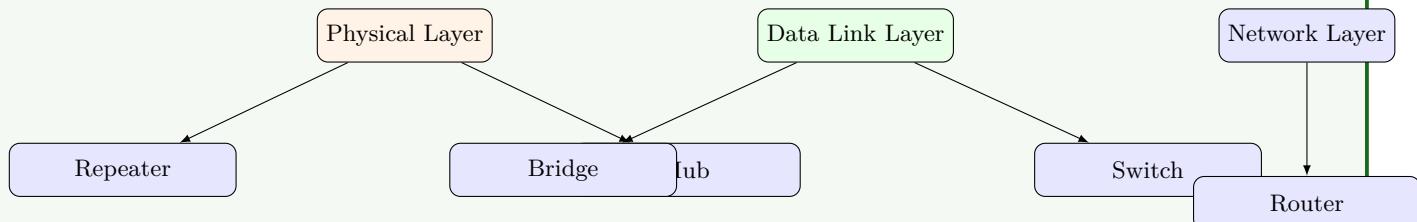


Figure 5. Network Devices by Layer

### Device Functions:

- **Repeater:** Amplifies and regenerates signals
- **Hub:** Simple connection point for multiple devices
- **Bridge:** Intelligent forwarding based on MAC addresses
- **Switch:** High-performance bridge with multiple ports
- **Router:** Intelligent path selection between networks
- **Gateway:** Complete protocol stack conversion

### Mnemonic

“Repeat, Hub, Bridge, Switch, Route, Gateway”

## Question 3(a) [3 marks]

Name any three data link layer protocol and explain any one in detail.

### Solution

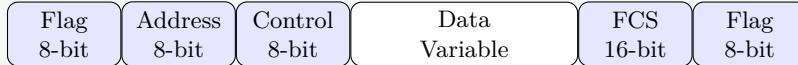
#### Data Link Layer Protocols:

- **HDLC** (High-Level Data Link Control)
- **PPP** (Point-to-Point Protocol)
- **Ethernet** (IEEE 802.3)

#### HDLC Protocol Details:

- **Frame Structure:** Flag, Address, Control, Data, FCS, Flag
- **Error Detection:** Frame Check Sequence (FCS)
- **Flow Control:** Sliding window mechanism

#### HDLC Frame Format:



**Figure 6.** HDLC Frame Structure

### Mnemonic

“HDLC = High Data Link Control”

## Question 3(b) [4 marks]

Explain error control and flow control at data link layer

### Solution

Control Type	Purpose	Methods
<b>Error Control</b>	Detect and correct transmission errors	CRC, Checksum, Parity
<b>Flow Control</b>	Manage data transmission rate	Stop-and-Wait, Sliding Window

**Table 8.** Error vs Flow Control

#### Error Control Methods:

- **Detection:** CRC, Checksum identify errors
- **Correction:** ARQ (Automatic Repeat Request)
- **Prevention:** Forward Error Correction (FEC)

#### Flow Control Methods:

- **Stop-and-Wait:** Send one frame, wait for ACK
- **Sliding Window:** Send multiple frames before ACK
- **Buffer Management:** Prevent receiver overflow

### Mnemonic

“Error = Detect, Flow = Control”

## Question 3(c) [7 marks]

Compare IPv6 and IPv4.

### Solution

Feature	IPv4	IPv6
<b>Address Length</b>	32 bits	128 bits
<b>Address Space</b>	4.3 billion	340 undecillion
<b>Header Size</b>	20-60 bytes (variable)	40 bytes (fixed)
<b>Notation</b>	Decimal (192.168.1.1)	Hex (2001:db8::1)
<b>Fragmentation</b>	Router and host	Host only
<b>Security</b>	Optional (IPSec)	Built-in (IPSec)
<b>Configuration</b>	Manual/DHCP	Auto-configuration

Table 9. IPv4 vs IPv6 Comparison

**IPv4 Example:** 192.168.1.100

**IPv6 Example:** 2001:0db8:85a3:0000:0000:8a2e:0370:7334

### Key Differences:

- Address Exhaustion:** IPv4 addresses nearly exhausted
- Header Efficiency:** IPv6 simplified header structure
- Security:** IPv6 has built-in security features
- Quality of Service:** Better QoS support in IPv6

### Mnemonic

“IPv6 = Infinite, Integrated, Improved”

## Question 3(a OR) [3 marks]

Explain the differences between guided and unguided transmission media used in computer networks

### Solution

Media Type	Guided	Unguided
<b>Definition</b>	Physical path exists	No physical path
<b>Examples</b>	Twisted pair, Coax, Fiber	Radio, Microwave, Satellite
<b>Direction</b>	Point-to-point	Broadcast

Table 10. Guided vs Unguided Media

### Guided Media:

- Twisted Pair:** Telephone lines, LANs
- Coaxial Cable:** Cable TV, older networks
- Fiber Optic:** High-speed, long-distance

### Unguided Media:

- Radio Waves:** WiFi, Bluetooth
- Microwaves:** Point-to-point links

- **Infrared:** Short-range communication

**Mnemonic**

“Guided = Ground, Unguided = Air”

**Question 3(b OR) [4 marks]**

Describe circuit switching and packet switching.

**Solution**

Feature	Circuit Switching	Packet Switching
<b>Connection</b>	Dedicated path established	No dedicated path
<b>Resource Allocation</b>	Fixed bandwidth	Shared resources
<b>Example</b>	Traditional telephone	Internet
<b>Delay</b>	Constant	Variable

**Table 11.** Circuit vs Packet Switching

**Circuit Switching:**

- **Setup Phase:** Establishes dedicated connection
- **Data Transfer:** Continuous transmission
- **Teardown:** Releases connection resources

**Packet Switching:**

- **Store-and-Forward:** Packets stored at intermediate nodes
- **Dynamic Routing:** Each packet routed independently
- **Resource Sharing:** Bandwidth shared among users

**Mnemonic**

“Circuit = Continuous, Packet = Pieces”

**Question 3(c OR) [7 marks]**

Explain IPv4 OR IPv6 in detail.

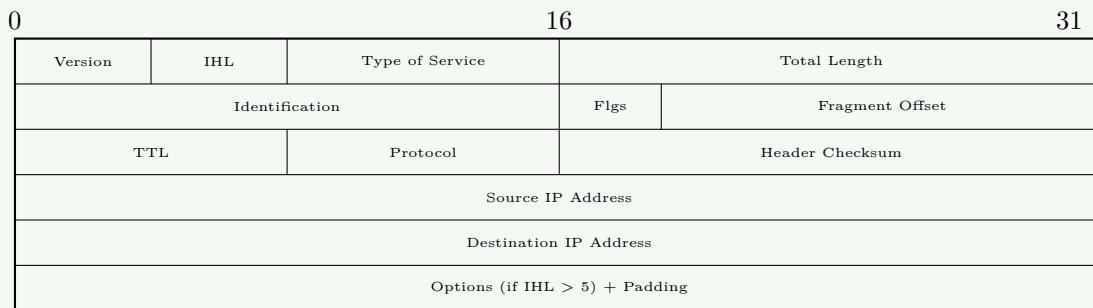
**Solution****IPv4 Address Structure:**

- **32-bit Address:** Divided into 4 octets
- **Dotted Decimal:** 192.168.1.1 format
- **Network + Host:** Address split into network and host portions

Class	Range	Network Bits	Host Bits	Use
A	1-126	8	24	Large networks
B	128-191	16	16	Medium networks
C	192-223	24	8	Small networks

**Table 12.** IPv4 Classes**Special Addresses:**

- **Loopback:** 127.0.0.1 (local host)
- **Private:** 192.168.x.x, 10.x.x.x, 172.16-31.x.x
- **Broadcast:** 255.255.255.255

**IPv4 Header:****Figure 7.** IPv4 Header Structure**Mnemonic**

“IPv4 = 4 octets, 32 bits, Classes A-C”

**Question 4(a) [3 marks]**

Give full name of ARP and RARP and describe them.

**Solution****Full Names:**

- **ARP:** Address Resolution Protocol
- **RARP:** Reverse Address Resolution Protocol

Protocol	Function
<b>ARP</b>	Maps IP address to MAC address
<b>RARP</b>	Maps MAC address to IP address

**Table 13.** ARP vs RARP**ARP Process:**

- **Request:** "Who has IP 192.168.1.1?"
- **Reply:** "192.168.1.1 is at MAC 00:1A:2B:3C:4D:5E"
- **Cache:** Stores mappings for future use

**RARP Process:**

- **Diskless Workstations:** Get IP from server
- **Broadcast Request:** Sends MAC address

- **Server Response:** Returns assigned IP address

#### Mnemonic

“ARP = Address to MAC, RARP = Reverse”

## Question 4(b) [4 marks]

Describe DSL technology with its advantages and limitations.

#### Solution

**DSL (Digital Subscriber Line):**

Type	Speed	Distance
<b>ADSL</b>	Up to 8 Mbps	5.5 km
<b>VDSL</b>	Up to 52 Mbps	1.5 km
<b>SDSL</b>	Up to 2 Mbps	3 km

**Table 14.** DSL Types

#### Advantages:

- **Existing Infrastructure:** Uses telephone lines
- **Always-On:** Continuous internet connection
- **Voice + Data:** Simultaneous phone and internet
- **Cost-Effective:** Affordable for home users

#### Limitations:

- **Distance Dependent:** Speed decreases with distance
- **Upload Speed:** Lower than download speed (ADSL)
- **Line Quality:** Affected by copper wire condition
- **Availability:** Not available in all areas

#### Mnemonic

“DSL = Digital Subscriber Line”

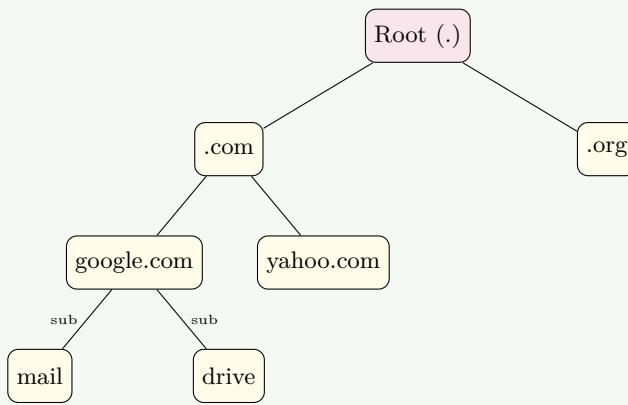
## Question 4(c) [7 marks]

Role of DNS- Domain Name System.

#### Solution

#### DNS Functions:

- **Name Resolution:** Converts domain names to IP addresses
- **Hierarchical Structure:** Organized in tree-like structure
- **Distributed Database:** Information stored across multiple servers

**Figure 8.** DNS Hierarchical Structure**DNS Hierarchy:**

- **Root Domain:** Highest level (.)
- **Top-Level Domain:** .com, .org, .net, .edu
- **Second-Level Domain:** google.com, yahoo.com
- **Subdomain:** www.google.com, mail.google.com

**DNS Resolution Process:**

1. **Client Query:** User types www.example.com
2. **Local DNS:** Checks local cache
3. **Root Server:** Queries root DNS server
4. **TLD Server:** Queries .com server
5. **Authoritative Server:** Gets IP address
6. **Response:** Returns IP to client

**DNS Record Types:**

- **A Record:** Maps domain to IPv4 address
- **AAAA Record:** Maps domain to IPv6 address
- **CNAME:** Canonical name (alias)
- **MX:** Mail exchange server
- **NS:** Name server records

**Mnemonic**

“DNS = Domain Name System”

**Question 4(a OR) [3 marks]**

Give full name of DHCP and BOOTP. and describe them.

**Solution****Full Names:**

- **DHCP:** Dynamic Host Configuration Protocol
- **BOOTP:** Bootstrap Protocol

Protocol	Function
<b>DHCP</b>	Automatically assigns IP addresses
<b>BOOTP</b>	Provides IP address to diskless workstations

**Table 15.** DHCP vs BOOTP

**DHCP Process:**

- **Discover:** Client broadcasts request
- **Offer:** Server offers IP address
- **Request:** Client requests specific IP
- **Acknowledge:** Server confirms assignment

**BOOTP Process:**

- **Static Configuration:** Pre-configured IP assignments
- **Diskless Boot:** Workstations boot from network
- **Server Response:** Provides IP and boot information

**Mnemonic**

“DHCP = Dynamic, BOOTP = Bootstrap”

**Question 4(b OR) [4 marks]**

Differences Between Virtual Circuits and Datagram Networks.

**Solution**

Feature	Virtual Circuits	Datagram Networks
<b>Connection</b>	Connection-oriented	Connectionless
<b>Setup</b>	Requires setup phase	No setup required
<b>Routing</b>	Same path for all packets	Independent routing
<b>Order</b>	Packets arrive in order	May arrive out of order
<b>Reliability</b>	More reliable	Less reliable
<b>Overhead</b>	Higher setup overhead	Lower per-packet overhead

Table 16. Virtual Circuits vs Datagram Networks

**Virtual Circuits:**

- **Path Establishment:** Creates virtual connection
- **State Information:** Maintains connection state
- **Examples:** ATM, Frame Relay

**Datagram Networks:**

- **Independent Packets:** Each packet routed separately
- **Stateless:** No connection state maintained
- **Examples:** Internet Protocol (IP)

**Mnemonic**

“Virtual = Connection, Datagram = Independent”

**Question 4(c OR) [7 marks]**

Explain TCP and UDP protocol in transport layer

## Solution

Feature	TCP	UDP
<b>Connection</b>	Connection-oriented	Connectionless
<b>Reliability</b>	Reliable	Unreliable
<b>Header Size</b>	20 bytes	8 bytes
<b>Flow Control</b>	Yes	No
<b>Error Control</b>	Yes	Basic
<b>Speed</b>	Slower	Faster

Table 17. TCP vs UDP

### TCP (Transmission Control Protocol):

- **Three-Way Handshake:** SYN, SYN-ACK, ACK
- **Flow Control:** Sliding window mechanism
- **Error Recovery:** Retransmission of lost packets
- **Congestion Control:** Prevents network overload

### TCP Header:

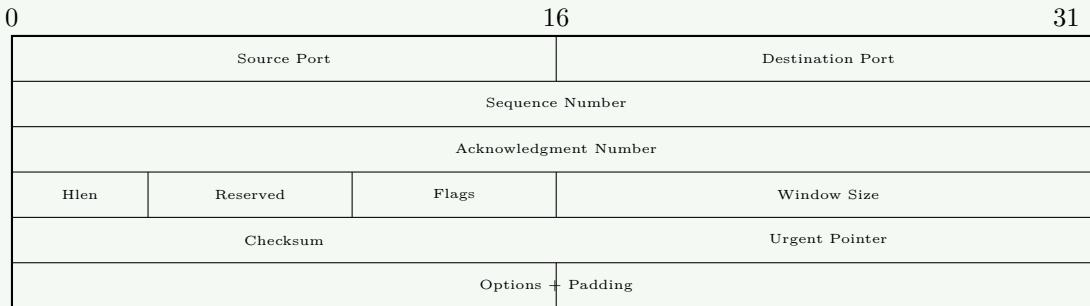


Figure 9. TCP Header Structure

### UDP (User Datagram Protocol):

- **Simple Protocol:** Minimal overhead
- **Best Effort:** No guarantee of delivery
- **Applications:** DNS, DHCP, streaming media
- **Real-time Communication:** Voice, video applications

### UDP Header:

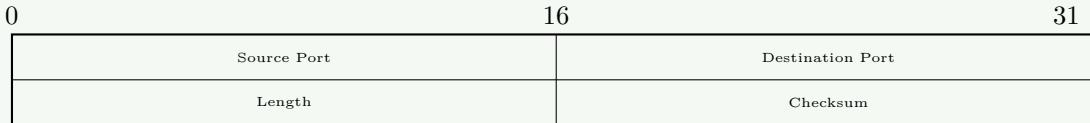


Figure 10. UDP Header Structure

### Applications:

- **TCP:** Web browsing, email, file transfer
- **UDP:** Online gaming, video streaming, DNS queries

## Mnemonic

“TCP = Reliable, UDP = Fast”

## Question 5(a) [3 marks]

Explain any two of following. (1) WWW (2) FTP (3) SMTP

### Solution

**WWW (World Wide Web):**

- **HTTP Protocol:** HyperText Transfer Protocol
- **Web Browser:** Client software (Chrome, Firefox)
- **Web Server:** Serves web pages (Apache, IIS)

**FTP (File Transfer Protocol):**

- **File Transfer:** Upload and download files
- **Two Modes:** Active and passive mode
- **Authentication:** Username and password required

Service	Port	Function
WWW	80/443	Web page delivery
FTP	20/21	File transfer

Table 18. WWW vs FTP

### Mnemonic

“WWW = Web, FTP = Files”

## Question 5(b) [4 marks]

Difference between symmetric and asymmetric encryption algorithms.

### Solution

Feature	Symmetric	Asymmetric
<b>Keys</b>	Same key for encryption and decryption	Different keys (public/private)
<b>Speed</b>	Fast	Slow
<b>Key Distribution</b>	Difficult	Easy
<b>Examples</b>	AES, DES	RSA, ECC

Table 19. Symmetric vs Asymmetric Encryption

**Symmetric Encryption:**

- **Single Key:** Same key used by sender and receiver
- **Key Management:** Secure key distribution required
- **Performance:** Fast encryption/decryption
- **Applications:** Bulk data encryption

**Asymmetric Encryption:**

- **Key Pair:** Public key for encryption, private key for decryption
- **Key Distribution:** Public key can be shared openly
- **Performance:** Slower than symmetric
- **Applications:** Digital signatures, key exchange

**Mnemonic**

“Symmetric = Same, Asymmetric = Different”

**Question 5(c) [7 marks]**

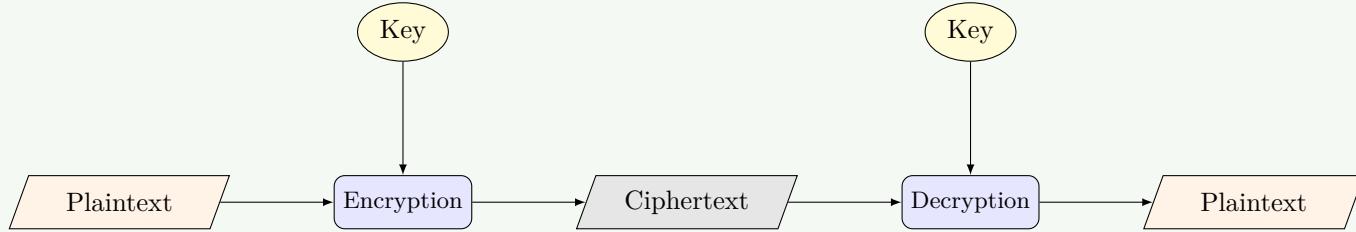
Define the terms “encryption” and “decryption” in the context of cryptography.

**Solution****Encryption:**

- **Definition:** Process of converting plaintext into ciphertext
- **Purpose:** Protect data confidentiality
- **Input:** Plaintext + Key
- **Output:** Ciphertext

**Decryption:**

- **Definition:** Process of converting ciphertext back to plaintext
- **Purpose:** Retrieve original data
- **Input:** Ciphertext + Key
- **Output:** Plaintext



**Figure 11.** Cryptography Process

**Cryptographic Process:**

1. **Sender:** Encrypts message using key
2. **Transmission:** Sends ciphertext over network
3. **Receiver:** Decrypts ciphertext using key
4. **Recovery:** Gets original plaintext message

**Types of Encryption:**

- **Stream Cipher:** Encrypts one bit/byte at a time
- **Block Cipher:** Encrypts fixed-size blocks

**Question 5(a OR) [3 marks]**

Difference between IMAP and POP3

**Solution**

Feature	IMAP	POP3
<b>Storage</b>	Server-side	Client-side
<b>Access</b>	Multiple devices	Single device
<b>Offline</b>	Limited	Full access

**Table 20.** IMAP vs POP3

**IMAP (Internet Message Access Protocol):**

- **Server Storage:** Messages remain on server
- **Multi-Device:** Access from multiple devices
- **Synchronization:** Changes sync across devices

**POP3 (Post Office Protocol 3):**

- **Download:** Messages downloaded to client
- **Single Device:** Best for one device access
- **Storage:** Client manages message storage

**Mnemonic**

“IMAP = Internet Access, POP3 = Post Office”

## Question 5(b OR) [4 marks]

Briefly describe the Information Technology (Amendment) Act, 2008, and its impact on cyber laws in India.

**Solution****IT Act 2008 Key Features:**

- **Cyber Crimes:** Defines various cyber offenses
- **Data Protection:** Privacy and security requirements
- **Digital Signatures:** Legal recognition of e-signatures
- **Penalties:** Fines and imprisonment for violations

**Major Amendments:**

- **Section 66A:** Criminalized offensive messages (later struck down)
- **Section 69:** Government power to intercept information
- **Section 72A:** Punishment for disclosure of personal information
- **Section 43A:** Compensation for data breach

**Impact on Cyber Laws:**

- **Legal Framework:** Comprehensive cyber law structure
- **Business Compliance:** Data protection requirements
- **Individual Rights:** Privacy protection mechanisms
- **Law Enforcement:** Tools for investigating cyber crimes

**Mnemonic**

“IT Act = Internet Technology Act”

## Question 5(c OR) [7 marks]

Difference between symmetric and asymmetric encryption algorithms.

## Solution

Aspect	Symmetric Encryption	Asymmetric Encryption
<b>Key Usage</b>	Same key for encrypt/decrypt	Different keys (public/private)
<b>Key Management</b>	Difficult key distribution	Easy key distribution
<b>Performance</b>	Fast processing	Slow processing
<b>Key Length</b>	Shorter keys (128-256 bits)	Longer keys (1024-4096 bits)
<b>Scalability</b>	Poor ( $n^2$ key pairs needed)	Good ( $n$ key pairs needed)

Table 21. Symmetric vs Asymmetric Detailed Comparison

### Symmetric Encryption Details:

- **Algorithm Types:** Stream ciphers, Block ciphers
- **Key Distribution Problem:** Secure channel needed for key exchange
- **Applications:** Bulk data encryption, VPNs, file encryption

### Asymmetric Encryption Details:

- **Public Key Infrastructure:** PKI for key management
- **Digital Signatures:** Authentication and non-repudiation
- **Applications:** Email security, SSL/TLS, digital certificates

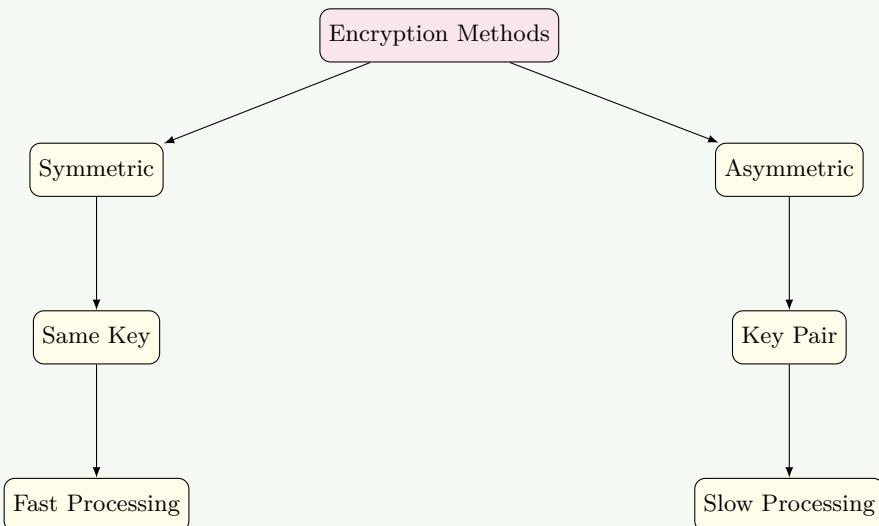


Figure 12. Encryption Methods Classification

### Real-world Applications:

- **Banking:** ATM transactions use symmetric encryption
- **E-commerce:** HTTPS uses hybrid encryption
- **Email:** PGP uses asymmetric for key exchange
- **Mobile:** WhatsApp uses end-to-end encryption

## Mnemonic

“Symmetric = Same Speed, Asymmetric = Advanced Security”