S-1

1. Need for Network Topologies

Network topologies organize devices for efficient communication, scalability, troubleshooting, cost-effectiveness, performance optimization, and security planning.

2. Types of Network Topologies

1. **Bus**: Single backbone; simple but prone to failure.
2. **Star**: Devices connect to a hub; scalable but hub-dependent.
3. **Ring**: Circular connection; predictable but failure-sensitive.
4. **Mesh**: Every device connects to others; highly reliable but costly.
5. **Tree**: Hierarchical design; scalable but parent-dependent.
6. **Hybrid**: Combines multiple topologies; flexible but complex.

3. Hybrid Topology in Cisco Packet Tracer

- Combine bus (PCs connected to a switch) and star (hub with devices).
- Use routers to integrate the systems.
- Assign IPs and test connectivity via "Ping."

4. Results and Conclusion

- **Results**: Devices communicated seamlessly with minimal latency.
- **Conclusion**: Hybrid topology offers flexibility, scalability, and robustness, making it ideal for complex networks despite higher costs and complexity.

S-2

1. Advantages of IoT-Based Home Automation in Computer Networks

- **Convenience**: Control devices remotely via mobile or voice.
- **Energy Efficiency**: Optimized power usage through smart scheduling.
- **Security**: Real-time surveillance and alerts.
- **Interoperability**: Seamless integration with various smart devices.
- **Cost Saving**: Long-term reductions in utility bills.

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2. IoT Remote Server Functions and Applications

- **Functions**:
  - Device management, data storage, and real-time communication.
  - Controls devices through APIs and cloud services.
  - Analyzes and processes IoT data for automation.
- **Applications**:
  - Smart homes, industrial automation, healthcare monitoring, and transportation systems.

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3. Switch Functions and Applications

- **Functions**:
  - Connects multiple devices within the same network.
  - Ensures data is forwarded to the correct device using MAC addresses.
  - Reduces network congestion through VLANs and QoS.
- **Applications**:
  - Used in LANs for efficient device communication.
  - Common in office, enterprise, and data center networks.

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4. Wireless Router Functions and Applications

- **Functions**:
  - Connects devices to the internet wirelessly.
  - Routes data packets between devices and networks.
  - Provides security via firewalls and encryption.
- **Applications**:
  - Home and office networks, public Wi-Fi hotspots, and IoT ecosystems.

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5. IoT-Based Smart Home Automation in Cisco Packet Tracer

Steps:

1. Drag smart devices (lights, fans, cameras) and IoT components.
2. Add a wireless router and connect devices.
3. Configure an IoT server to manage devices.
4. Assign IPs to devices and configure automation rules (e.g., lights turn on at dusk).
5. Test functionality by simulating triggers and observing responses.

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6. Results and Conclusion

- **Results**: IoT-based automation successfully controlled smart devices based on predefined conditions. Seamless communication was achieved.
- **Conclusion**: IoT home automation enhances convenience, energy efficiency, and security. Its implementation in Cisco Packet Tracer demonstrates its feasibility and practical benefits for modern smart homes.

S-3

1. Color Code Diagram for Straight Connections

Straight-through cables follow the same wiring standard (T568B or T568A) on both ends.

T568B Color Code:

1. Orange/White
2. Orange
3. Green/White

4. Blue
5. Blue/White
6. Green
7. Brown/White
8. Brown

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2. Features of Ethernet Cables and Types

- **Features**: High-speed data transfer, low latency, durability, and noise resistance.
- **Types**:
  - **Cat5**: Up to 100 Mbps.
  - **Cat5e**: Up to 1 Gbps, reduced crosstalk.
  - **Cat6**: Up to 10 Gbps for short distances, better shielding.
  - **Cat6a**: Supports 10 Gbps at longer distances.
  - **Cat7**: Enhanced shielding and higher speeds.

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3. UTP vs. STP

Aspect	UTP	STP
Shielding	Unshielded	Shielded
Cost	Cheaper	More expensive
Noise Resistance	Lower	Higher
Flexibility	More flexible	Less flexible
Use Case	Home and small networks	Industrial or noisy environments

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4. RJ45 Connector and CAT Cable Implementation

Steps:

1. Strip the CAT cable and arrange wires as per T568B.
2. Insert wires into the RJ45 connector in order.
3. Use a crimping tool to secure the connector.
4. Test the connection with an Ethernet cable tester for continuity.

5. Results and Conclusion

- **Results**: Successful connection with all pins showing continuity on the tester.
- **Conclusion**: Straight connections using CAT cables and RJ45 connectors ensure reliable communication for Ethernet networks.

S-4

1. Color Code Diagram for Crossover Connections

Crossover cables use different standards (T568B on one end and T568A on the other).

T568A:

T568B:

1. Orange/White
2. Orange
3. Green/White
4. Blue
5. Blue/White
6. Green

1. Green/White
2. Green
3. Orange/White
4. Blue
5. Blue/White
6. Orange
7. Brown/White
8. Brown

2. Features of Ethernet Cables and Types

- **Features**: Durable, low interference, and support high-speed data transfer.
- **Types**:
  - **Cat5**: Up to 100 Mbps, basic use.
  - **Cat5e**: Up to 1 Gbps, reduced interference.
  - **Cat6**: Up to 10 Gbps over short distances, better shielding.
  - **Cat6a**: Enhanced speeds over longer distances.
  - **Cat7**: Superior shielding, high speeds.

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3. UTP vs. STP

Aspect	UTP	STP
Shielding	No shielding	Shielded to prevent interference
Cost	Cheaper	More expensive
Noise Resistance	Moderate	High
Flexibility	More flexible	Less flexible
Use Case	Home/small networks	Industrial/high-interference areas

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4. Implementing RJ45 Connector and CAT Cable for Crossover

Steps:

1. Strip the cable ends and arrange one as per T568A and the other as per T568B.
2. Insert wires into RJ45 connectors in order.
3. Use a crimping tool to secure connectors.
4. Test the cable with an Ethernet tester to ensure proper crossover functionality.

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5. Results and Conclusion

- **Results**: Successful crossover connection with correct pin mappings tested using a cable tester.
- **Conclusion**: Crossover cables are ideal for direct device-to-device communication (e.g., PC to PC) and are easy to construct with proper tools and standards.

1. Process of Capturing Packets Using Wireshark

1. Open Wireshark and select the desired network interface.
2. Start capturing by clicking on the green "Start" button.
3. Perform network activities (e.g., browsing, pinging).
4. Stop capturing by clicking on the red "Stop" button.
5. Analyse captured packets in the main window.

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2. Key Components of a Captured Packet

- **MAC Address**: Source and destination hardware addresses.
- **IP Address**: Source and destination IPs for identifying devices.
- **TCP/UDP Ports**: Indicates the application-layer protocol.
- **Payload**: Data transmitted between devices.

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4. Results and Conclusion

- **Results**: Captured packets showed distinct structures for protocols like TCP, UDP, HTTP, DNS, and ICMP, with visible headers and data fields.
- **Conclusion**: Wireshark effectively analyses network traffic, helping identify and debug issues in various protocols. It is a powerful tool for network troubleshooting and education.

S-6

1. Roles of Parity Bits in Hamming Code

- Detect and correct single-bit errors.
- Each parity bit covers specific data bits to check for errors using even or odd parity.

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2. How Hamming Code Ensures Single-Bit Error Correction

- During transmission, parity bits are recalculated.
- The position of the error is identified using the binary combination of incorrect parity bits.
- The erroneous bit is flipped to correct the error.

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3. Observations

- Parity bits follow 2n2^n2n positions (1st, 2nd, 4th, etc.).
- A single-bit error changes specific parity bit calculations, pinpointing the error location.

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4. Results and Conclusion

- **Results**: Hamming Code accurately detected and corrected single-bit errors during testing.
- **Conclusion**: Hamming Code is an efficient error-detection and correction method for reliable data transmission in communication systems.