ASSIGNMENT-2

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- 230391773822039

Part A – NIC & Hardware Basics

1. What is the name of your primary Network Interface Card (NIC)?

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
```

Primary NIC Name: Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC

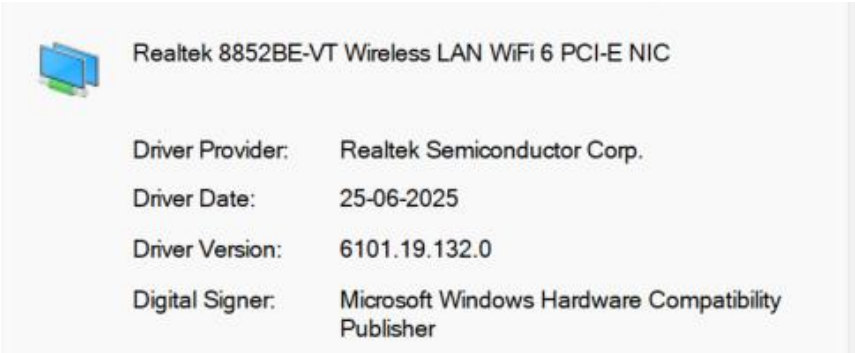
2. How many NICs are available in your system (wired, wireless, virtual)?

```
Wireless LAN adapter Wi-Fi 3:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC #3
   Physical Address. . . . . . . . . : FE-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi 5:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC #5
   Physical Address. . . . . . . . . : FA-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::150e:c824:b7ce:a91b%20(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.11.218.109(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.128.0
   Lease Obtained. . . . . . . . . . : 29 September 2025 02:58:56 PM
   Lease Expires . . . . . . . . . . : 30 September 2025 11:07:36 AM
   Default Gateway . . . . . . . . . : 10.11.128.1
   DHCP Server . . . . . . . . . . . : 10.11.128.1
   DHCPv6 IAID . . . . . . . . . . . : 217595334
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2F-D4-F8-B2-60-7D-09-79-2C-E5
   DNS Servers . . . . . . . . . . . : 172.16.0.4
                                       172.16.0.5
   NetBIOS over Tcpip. . . . . . . . : Enabled

C:\Users\Varshini Priya>
```

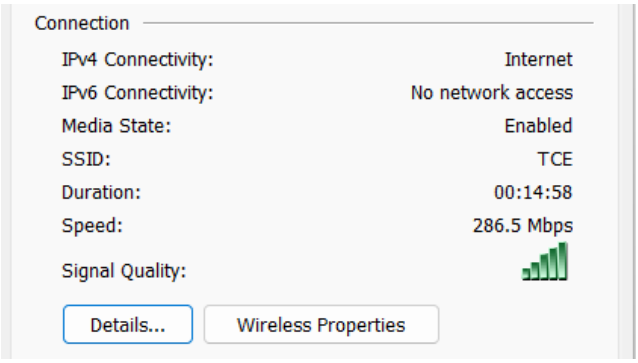
Total NICs: 3

- 2 - Virtual NICs (Wi-Fi 3: Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC #3, Wi-Fi 5: Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC #5)
- 1 - Physical Wireless NIC (Wi-Fi: Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC)

3. **What is the driver name/version of your NIC?**



4. **Find the speed supported by your NIC (e.g., 100 Mbps, 1 Gbps).**



5. **Is your NIC currently in an enabled or disabled state?**

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::150e:c824:b7ce:a91b%21(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.5(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 29 October 2025 06:32:53 PM
   Lease Expires . . . . . . . . . . : 05 November 2025 06:32:53 PM
   Default Gateway . . . . . . . . . : 192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DHCPv6 IAID . . . . . . . . . . . : 217595334
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2F-D4-F8-B2-60-7D-09-79-2C-E5
   DNS Servers . . . . . . . . . . . : 61.1.1.1
                                       8.8.4.4
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

NIC Status: Enabled and Connected

Part B – IP Addressing

1. **What is your system's IPv4 address?**

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::150e:c824:b7ce:a91b%21(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.5(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 29 October 2025 06:32:53 PM
   Lease Expires . . . . . . . . . . : 05 November 2025 06:32:53 PM
   Default Gateway . . . . . . . . . : 192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DHCPv6 IAID . . . . . . . . . . . : 217595334
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2F-D4-F8-B2-60-7D-09-79-2C-E5
   DNS Servers . . . . . . . . . . . : 61.1.1.1
                                       8.8.4.4
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

My System's IPv4 address is 192.168.1.5

2. **What is your system's IPv6 address?**

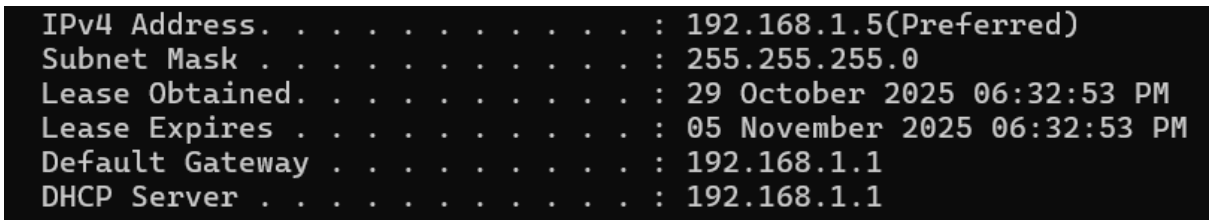
```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::150e:c824:b7ce:a91b%21(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.5(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 29 October 2025 06:32:53 PM
   Lease Expires . . . . . . . . . . : 05 November 2025 06:32:53 PM
   Default Gateway . . . . . . . . . : 192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DHCPv6 IAID . . . . . . . . . . . : 217595334
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2F-D4-F8-B2-60-7D-09-79-2C-E5
   DNS Servers . . . . . . . . . . . : 61.1.1.1
                                       8.8.4.4
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

My System's IPv6 address is fe80::150e:c824:b7ce:a91b%20

3. **Identify whether your IPv4 address is private or public. Explain why.**
   IPv4 Address: 10.11.218.109

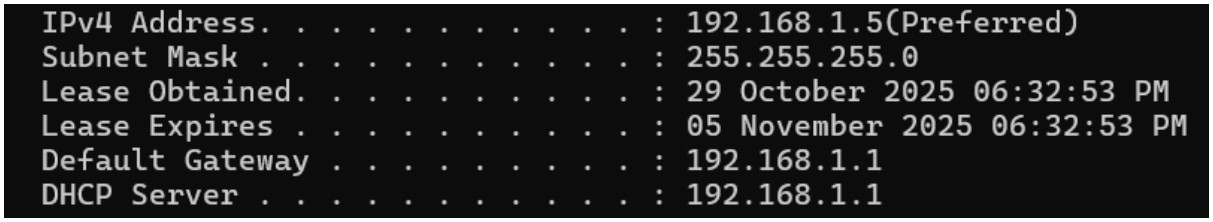
   It is a private IP address because it starts with 10, which is a range reserved for private networks according to RFC 1918.

4. **What is the subnet mask of your network?**



SUBNET MASK:- 255.255.255.0

5. What is your default gateway IP address?



DEFAULT GATEWAY IP:- 192.168.1.1

6. Determine the class (A/B/C/D/E) of your IPv4 address. Explain why.

IPv4 address: 192.168.1.5

Class ranges:

- Class A: 1 – 126
- Class B: 128 – 191
- Class C: 192 – 223
- Class D: 224 – 239
- Class E: 240 – 255

So, the address belongs to Class C, because its 1st octet (192) lies in the range 192–223.

7. For your IPv4 address, identify the Network ID.

Network ID = Perform bitwise AND of IP and mask:

- IP: 192.168.1.5
- Subnet: 255.255.255.0
- AND each octet:
  - 192 AND 255 = 192
  - 168 AND 255 = 168
  - 1 AND 255 = 1
  - 5 AND 0 = 0

So, the Network ID: 192.168.1.0

8. For your IPv4 address, identify the Host ID.

IP: 192.168.1.5

Host ID = Part of the address after the network bits. With subnet 255.255.255.0 (/24), the last octet is the host portion.

Host ID: 0.0.0.5 (or simply 5)

9. How many hosts can exist in your network (based on subnet mask)?

For mask 255.255.255.0 → there are 8 bits for host part.

Formula = 2^n − 2 (subtract network & broadcast)

= 2^8 − 2

= 256 − 2

= 254 hosts

Maximum number of usable hosts = 254

PART C – MAC ADDRESS

1. What is the MAC address of your NIC?

The **MAC address** of the Wi-Fi network interface card (NIC) in my system is **F8-3D-C6-72-3E-04**.

This is the **physical address** (unique hardware identifier) assigned to the Realtek 8852BE-VT Wireless LAN Wi-Fi 6 PCI-E NIC.

Other interfaces on my system:

- Bluetooth MAC Address – **F8-3D-C6-72-3E-05**
- McAfee VPN Virtual Adapter MAC – **00-FF-D2-63-C4-DC**

2. What is the MAC address format (number of bits, number of hex digits, separation style)?

A MAC address is **48 bits** long, consisting of **12 hexadecimal digits**.

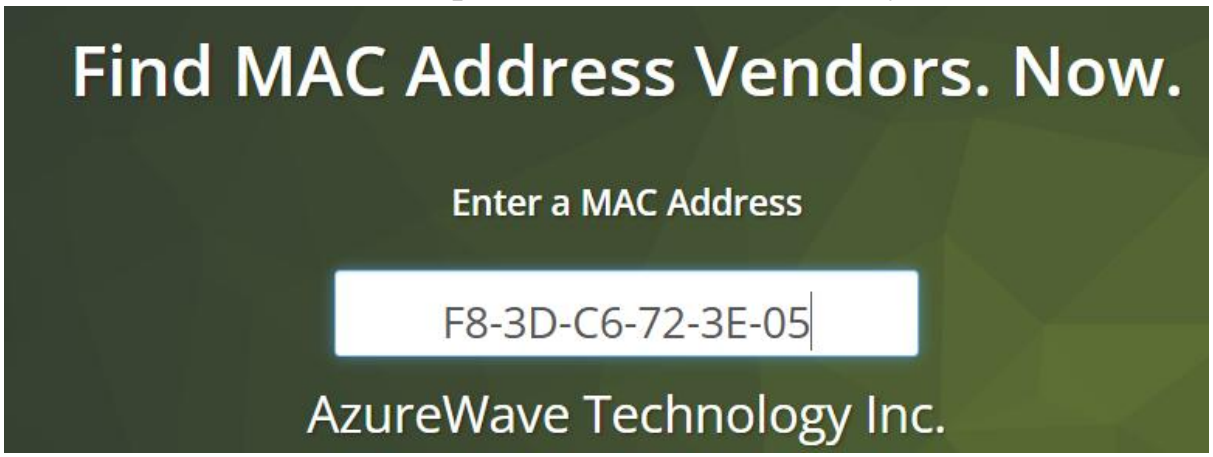
It is displayed as **6 pairs** (octets) of hex digits separated by **hyphens (-)** or **colons (:)**.

For example: F8-3D-C6-72-3E-04 or F8:3D:C6:72:3E:04.

The **first 3 octets** represent the **OUI (Organizationally Unique Identifier)** – the vendor code,

and the **last 3 octets** represent the **device-specific identifier** assigned by the manufacturer.

3. Use an online MAC lookup tool to find the vendor of your NIC.



4. Compare the MAC address of your Wi-Fi NIC and Ethernet NIC. What do you observe?

In my system, the wired Ethernet adapter is currently disconnected, so only the Wi-Fi and Bluetooth interfaces are active.

The **Wi-Fi MAC address is F8-3D-C6-72-3E-04**,

and the **Bluetooth MAC address is F8-3D-C6-72-3E-05**.

Both share the same vendor prefix (F8-3D-C6) and differ only in the last octet.

This indicates that both interfaces belong to the same wireless module, where sequential MACs are assigned to different interfaces (Wi-Fi and Bluetooth).

6. Can MAC addresses be changed?

Yes, the MAC address can be changed (a process called MAC spoofing).

Every network card has a factory-assigned MAC, but the operating system allows users to temporarily change it for privacy or testing purposes.

On Windows, it can be changed through:

• Device Manager → Network Adapter → Properties → Advanced → Network Address (or Locally Administered Address),

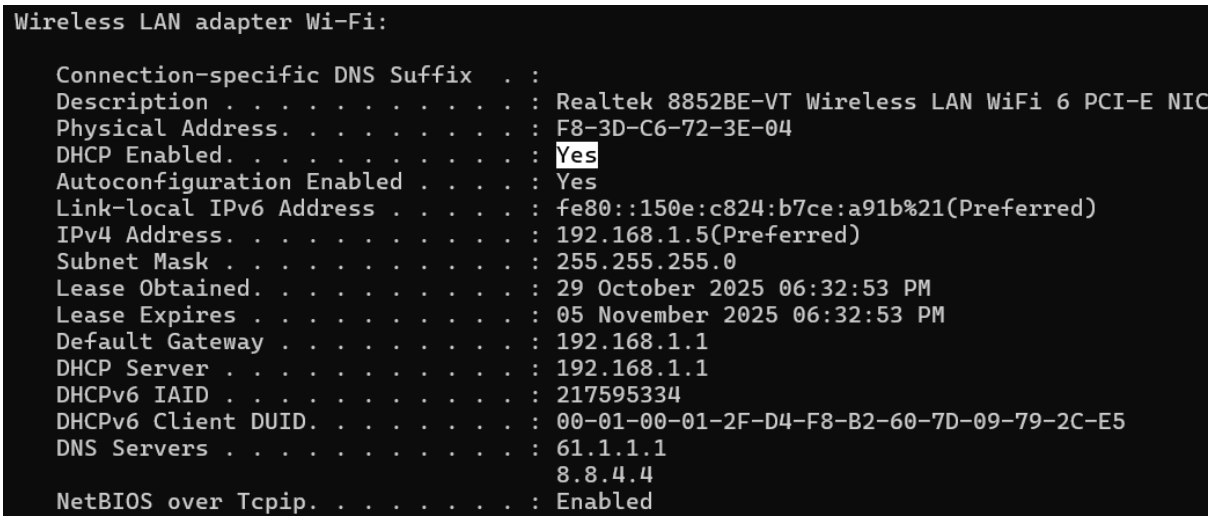
or by using netsh commands or third-party utilities.

This change is software-based and usually resets when the device or driver restarts.

However, altering the MAC may affect network connectivity or violate network policies if not permitted.

Basic IP & DHCP

1. Is your current IP address statically assigned or dynamically assigned via DHCP? How can you confirm?



My system's IP address is dynamically assigned via DHCP.

This is confirmed from the ipconfig /all output where it states:

• DHCP Enabled : Yes

• DHCP Server : 192.168.1.1

These lines indicate that the IP address 192.168.1.5 was automatically obtained from the DHCP server (most likely my Wi-Fi router).

2. Run the command to renew your IP address (ipconfig /renew on Windows). Did your IP change? Why/why not?

After running this command, my IP address remained the same (192.168.1.5).

This happened because the DHCP server generally tries to reassign the same IP to a device within its valid lease period.

If the lease had expired or if the address pool changed, the IP could have been reassigned.

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::150e:c824:b7ce:a91b%21(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.5(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 29 October 2025 06:32:53 PM
   Lease Expires . . . . . . . . . . : 05 November 2025 06:32:53 PM
   Default Gateway . . . . . . . . . : 192.168.1.1
```

3. What is the lease time of your DHCP-assigned IP? How can you find it?

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek 8852BE-VT Wireless LAN WiFi 6 PCI-E NIC
   Physical Address. . . . . . . . . : F8-3D-C6-72-3E-04
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::150e:c824:b7ce:a91b%21(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.5(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 29 October 2025 06:32:53 PM
   Lease Expires . . . . . . . . . . : 05 November 2025 06:32:53 PM
   Default Gateway . . . . . . . . . : 192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DHCPv6 IAID . . . . . . . . . . . : 217595334
```

4. Identify the DHCP server's IP address in your network

```
 Lease Obtained. . . . . . . . . . : 29 October 2025 06:32:53 PM
 Lease Expires . . . . . . . . . . : 05 November 2025 06:32:53 PM
 Default Gateway . . . . . . . . . : 192.168.1.1
 DHCP Server . . . . . . . . . . . : 192.168.1.1
 DHCPv6 IAID . . . . . . . . . . . : 217595334
 DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2F-D4-F8-B2-60-7D-09-79-2C-E5
```

5. Explain what would happen if the DHCP server goes down in your LAN

If the DHCP server fails or goes offline, the following will occur:

• Existing devices with active leases can continue to use their IP addresses until the lease expires.

• New devices joining the network will not receive an IP address, so they will be unable to communicate on the network or access the internet.

• After lease expiry, even existing devices will lose connectivity because they cannot renew their IPs.

DHCP Functions & Exploration

1. What are the main functions of DHCP in a network?

Main Functions of DHCP in a Network

- Automatic IP Address Assignment
  - DHCP automatically assigns a unique IP address to each device on the network.
  - This removes the need for manual IP configuration for every device.
- Distribution of Network Configuration Parameters

    - Along with IP addresses, DHCP provides important settings like subnet mask, default gateway, DNS servers, and domain name so that devices can communicate properly.
- IP Address Lease Management
    - DHCP gives IP addresses for a limited time period (called a lease).
    - After expiry, the lease can be renewed or reassigned, ensuring efficient reuse of IP addresses.
- Centralized and Simplified Administration
    - All configuration is managed from a single DHCP server.
    - This makes it easier to update or change network settings without visiting each device.
- Error Reduction and Consistency
    - Reduces manual errors like duplicate IPs or wrong subnet masks.
    - Ensures consistent configuration for all devices.
- Supports Both IPv4 and IPv6 Networks
    - DHCPv4 works with IPv4 networks.
    - DHCPv6 works with IPv6 networks and adds extra features like prefix delegation.

2. Explain the DORA process (Discover, Offer, Request, Acknowledge) of DHCP.

DORA Process of DHCP

The DORA process is the sequence of messages exchanged between a client and a DHCP server to get an IP address.
It stands for Discover → Offer → Request → Acknowledge.

Discover

- When a device connects to the network, it doesn't have an IP address.
- It sends a DHCP Discover broadcast message to find available DHCP servers.

Offer

- All DHCP servers that receive the Discover message respond with a DHCP Offer message.
- This offer contains an available IP address and configuration details (subnet mask, gateway, DNS, etc.).

Request

- The client chooses one of the offers and sends back a DHCP Request message to that server.
- This indicates that the client wants to use the offered IP address.

Acknowledge

- The DHCP server responds with a DHCP Acknowledgement (ACK) message.
  This confirms that the IP address has been assigned to the client for a lease period.

Part E – Advanced Exploration

1. Identify the loopback address of your system. Why is it important?

The loopback address of any system is 127.0.0.1, also called localhost.
It is important because:

- It is used to test the internal network stack of the computer.
- It helps verify that TCP/IP is correctly installed and functioning.
- It doesn't send packets over the physical network, all traffic stays within the system.
- It's useful for software testing (e.g., testing web servers locally).

2. Run ping 127.0.0.1. What is the result and why?

```
Pinging 127.0.0.1 with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Ping statistics for 127.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Interpretation:

- **bytes=32:** Each ICMP packet sent is 32 bytes in size.
- **time<1ms:** Round-trip time is less than 1 millisecond, extremely fast because it never leaves the local system.
- **TTL=128:** Time To Live, shows how many hops the packet could traverse.

3. What is the function of the ping command, and how does it help in network troubleshooting? Explain with examples from the output shown in the image.

The **ping** command is used to test **connectivity** between your computer and another device on the network or Internet.

Function:

- Sends ICMP Echo Request packets to a target host.
- Waits for ICMP Echo Reply packets.
- Measures response time (latency) and packet loss.

```
Ping statistics for 127.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

- 0% packet loss: All packets were successfully sent and received.
- RTT = 0ms: No delay because the traffic stayed inside your computer.

4. **Analyze the ping results for google.com, 8.8.8.8, and 8.8.4.4 shown in the image. What differences can be observed in their minimum, maximum, and average round trip times? What might these differences indicate about network performance and connectivity?**

Ping Results

Destination	Min RTT (ms)	Max RTT (ms)	Avg RTT (ms)
google.com	182	387	238
8.8.8.8	66	99	78
8.8.4.4	64	109	83

Observations:

- google.com (IPv6 address) has the highest RTTs and wide variation (182–387 ms).
- 8.8.8.8 and 8.8.4.4 (Google DNS IPv4 addresses) have lower and more stable RTTs.

This indicates that connecting to the website involves more hops, possible DNS resolution, and slightly higher latency. The lower and more consistent RTTs to Google DNS servers suggest faster and more stable network connectivity for direct IP communication.

5. **In the output for ping 8.8.8.8, there is a "Request timed out" message. Explain possible reasons for getting a request timeout during a ping operation and discuss how to troubleshoot this issue.**

   Possible Reasons:

   - Network issues: Temporary connection drop or Wi-Fi instability.
   - Firewall/Antivirus: Blocking ICMP packets.
   - Server-side ICMP filtering: Some servers may ignore ping requests.
   - Router or ISP congestion: Delayed or dropped packets.

   Troubleshooting Steps:

   - Check Internet connection or switch networks.
   - Disable firewall temporarily and retry.
   - Ping another IP to see if the problem persists.
   - Use tracert 8.8.8.8 to identify where packets are blocked.
   - Restart router or reconnect to Wi-Fi.

6. **Calculate the packet loss percentage for each ping test shown in the image. What does packet loss indicate about the reliability of the network connection between the host and the destination server?**

Formula:

$$\text{Packet Loss (\%)} = \frac{\text{Packets Sent} - \text{Packets Received}}{\text{Packets Sent}} \times 100$$

Destination	Sent	Received	Lost	Packet Loss (%)
google.com	4	4	0	0%
8.8.8.8	4	4	0	0%
8.8.4.4	4	4	0	0%

0% packet loss indicates the network connection is reliable and all packets successfully reached their destination and returned.

7. **Interpret the TTL (Time To Live) values observed in the ping results. What does TTL represent, and how can it provide information on the number of hops between the source and destination?**
   - 8.8.8.8 → TTL = 112 and 8.8.4.4 → TTL = 112
   - TTL indicates the maximum number of hops a packet can take.
   - Each router the packet passes decreases TTL by 1.
   - Original TTL for Windows is 128, so a TTL of 112 → roughly 16 hops between your computer and the Google server.