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Lab Practical #01:

Study of basic networking commands and IP configuration.

Practical Assignment #01:

1. Perform and explain various networking commands listed below:
 - i. ipconfig
 - ii. ping
 - iii. getmac
 - iv. systeminfo
 - v. traceroute / tracert
 - vi. netstat
 - vii. nslookup
 - viii. hostname
 - ix. pathping
 - x. arp

1. ipconfig

Description:

The ipconfig command is a Windows command-line utility that displays and manages the IP configuration of your computer's network interfaces.

No.	Option	Description
1	ipconfig	Displays IP address, subnet mask, and default gateway for all adapters.
2	ipconfig /all	Shows detailed info, including DNS, MAC address, DHCP status, etc.
3	ipconfig /release	Releases the current IP address (used with DHCP).
4	ipconfig /renew	Requests a new IP address from the DHCP server.
5	ipconfig /flushdns	Clears the DNS resolver cache.



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Implementation:

```
C:\Users\karan>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 1:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . :
    Link-local IPv6 Address . . . . . : fe80::46f:59d5:9d4b:5a53%5
    IPv4 Address. . . . . : 10.20.65.16
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . : 10.20.1.1
```

```
C:\Users\karan>ipconfig /all

Windows IP Configuration

Host Name . . . . . : Karan
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No

Ethernet adapter Ethernet:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :
    Description . . . . . : Realtek PCIe GbE Family Controller
    Physical Address. . . . . : A0-36-BC-68-26-30
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 1:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :
    Description . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
    Physical Address. . . . . : 52-5A-65-03-EF-A9
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :
    Description . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
    Physical Address. . . . . : 52-5A-65-03-EF-B9
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . :
    Description . . . . . : MediaTek Wi-Fi 6 MT7921 Wireless LAN Card
    Physical Address. . . . . : 58-5A-65-03-EF-99
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : fe80::46f:59d5:9d4b:5a53%5(Preferred)
    IPv4 Address. . . . . : 10.20.65.16(Preferred)
    Subnet Mask . . . . . : 255.255.0.0
    Lease Obtained. . . . . : 04 June 2025 08:26:03 AM
    Lease Expires . . . . . : 05 June 2025 08:26:03 AM
    Default Gateway . . . . . : 10.20.1.1
    DHCP Server . . . . . : 10.20.1.1
    DHCPv6 IAID . . . . . : 55597669
    DHCPv6 Client DUID. . . . . : 00-01-00-01-2E-47-99-A0-36-BC-68-26-30
    DNS Servers . . . . . : 10.20.1.1
    . . . . . : 8.8.8.8
```



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```
C:\Users\karan>ipconfig /release
```

Windows IP Configuration

No operation can be performed on Ethernet while it has its media disconnected.
No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

Ethernet adapter Ethernet:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 1:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 2:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . :
Link-local IPv6 Address : fe80::46f:59d5:9d4b:5a53%5
Default Gateway :

```
C:\Users\karan>ipconfig /renew
```

Windows IP Configuration

No operation can be performed on Ethernet while it has its media disconnected.
No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

Ethernet adapter Ethernet:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 1:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 2:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . :
Link-local IPv6 Address : fe80::46f:59d5:9d4b:5a53%5
IPv4 Address : 10.20.65.16
Subnet Mask : 255.255.0.0
Default Gateway : 10.20.1.1

```
C:\Users\karan>ipconfig /renew
```

Windows IP Configuration

No operation can be performed on Ethernet while it has its media disconnected.
No operation can be performed on Local Area Connection* 1 while it has its media disconnected.
No operation can be performed on Local Area Connection* 2 while it has its media disconnected.

Ethernet adapter Ethernet:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 1:

Media State : Media disconnected
Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 2:

Media State : Media disconnected
Connection-specific DNS Suffix . :

```
C:\Users\karan>ipconfig /flushdns
```

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.



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2. ping

Description:

The ping command is a network diagnostic tool used to test connectivity between your computer and another device (like a server, website, or IP address).

No.	Option	Description
1	ping -n 5 google.com	Sends a specific number of pings.
2	ping -t host	Pings the target continuously until stopped
3	ping -l 5 darshanums.in	Sets the size (in bytes) of the ping packet.
4	ping -4 darshanums.in	Forces use of IPv4.
5	ping -6 google.com	Forces use of IPv6.

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>ping -n 5 google.com

Pinging google.com [2607:f8b0:4002:c10::71] with 32 bytes of data:
Reply from 2607:f8b0:4002:c10::71: time=291ms
Reply from 2607:f8b0:4002:c10::71: time=293ms
Reply from 2607:f8b0:4002:c10::71: time=292ms
Reply from 2607:f8b0:4002:c10::71: time=291ms
Reply from 2607:f8b0:4002:c10::71: time=291ms

Ping statistics for 2607:f8b0:4002:c10::71:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 291ms, Maximum = 293ms, Average = 291ms
```

```
C:\Users\karan>ping -t google.com

Pinging google.com [2607:f8b0:4002:c09::8a] with 32 bytes of data:
Reply from 2607:f8b0:4002:c09::8a: time=282ms
Reply from 2607:f8b0:4002:c09::8a: time=282ms
Reply from 2607:f8b0:4002:c09::8a: time=283ms
Reply from 2607:f8b0:4002:c09::8a: time=281ms
Reply from 2607:f8b0:4002:c09::8a: time=282ms

Ping statistics for 2607:f8b0:4002:c09::8a:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 281ms, Maximum = 283ms, Average = 282ms
Control-C
```



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```
C:\Users\karan>ping -l 5 darshanums.in
```

```
Pinging darshanums.in [103.13.112.180] with 5 bytes of data:  
Reply from 103.13.112.180: bytes=5 time=18ms TTL=123  
Reply from 103.13.112.180: bytes=5 time=19ms TTL=123  
Reply from 103.13.112.180: bytes=5 time=19ms TTL=123  
Reply from 103.13.112.180: bytes=5 time=19ms TTL=123
```

```
Ping statistics for 103.13.112.180:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 18ms, Maximum = 19ms, Average = 18ms
```

```
C:\Users\karan>ping -4 darshanums.in
```

```
Pinging darshanums.in [103.13.112.180] with 32 bytes of data:  
Reply from 103.13.112.180: bytes=32 time=19ms TTL=123  
Reply from 103.13.112.180: bytes=32 time=19ms TTL=123  
Reply from 103.13.112.180: bytes=32 time=18ms TTL=123  
Reply from 103.13.112.180: bytes=32 time=19ms TTL=123
```

```
Ping statistics for 103.13.112.180:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 18ms, Maximum = 19ms, Average = 18ms
```

```
C:\Users\karan>ping -6 google.com
```

```
Pinging google.com [2607:f8b0:4002:c09::8a] with 32 bytes of data:  
Reply from 2607:f8b0:4002:c09::8a: time=283ms  
Reply from 2607:f8b0:4002:c09::8a: time=283ms  
Reply from 2607:f8b0:4002:c09::8a: time=282ms  
Reply from 2607:f8b0:4002:c09::8a: time=282ms
```

```
Ping statistics for 2607:f8b0:4002:c09::8a:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 282ms, Maximum = 283ms, Average = 282ms
```



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3. getmac

Description:

The getmac command is a Windows command-line utility that displays the MAC address (Media Access Control address) of your computer's network adapters.

No.	Option	Description
1	getmac /v	Displays verbose output (more detailed).
2	getmac /fo table	Format the output: TABLE, LIST, or CSV. Example: getmac /fo csv
3	getmac /nh	No headers in the output

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>getmac /v
```

```
Connection Name Network Adapter Physical Address Transport Name
=====
Wi-Fi           MediaTek Wi-Fi 50-5A-65-03-EF-99 \Device\Tcpip_{2D4A5C38-0D7E-42F7-8C80-AE2393457BCF}
Ethernet        Realtek PCIe Gb A0-36-BC-6B-26-30 Media disconnected
```

```
C:\Users\karan>getmac /fo table
```

```
Physical Address Transport Name
=====
50-5A-65-03-EF-99 \Device\Tcpip_{2D4A5C38-0D7E-42F7-8C80-AE2393457BCF}
A0-36-BC-6B-26-30 Media disconnected
```

```
C:\Users\karan>getmac /nh
```

```
50-5A-65-03-EF-99 \Device\Tcpip_{2D4A5C38-0D7E-42F7-8C80-AE2393457BCF}
A0-36-BC-6B-26-30 Media disconnected
```



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4. systeminfo

Description:

The systeminfo command is a Windows command-line tool that displays detailed information about your computer's hardware and software configuration.

No.	Option	Description
1	systeminfo	This command lists a comprehensive summary of system details.
2	system /s Karan	Get info from a remote computer.
3	system /fo [format]	Output format: TABLE, LIST, or CSV.

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>systeminfo

Host Name:                KARAN
OS Name:                  Microsoft Windows 11 Home Single Language
OS Version:               10.0.26100 N/A Build 26100
OS Manufacturer:         Microsoft Corporation
OS Configuration:        Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:         karan08338@outlook.com
Registered Organization:   N/A
Product ID:                00342-42630-23808-AAOEM
Original Install Date:     09-04-2025, 01:23:26 PM
System Boot Time:          03-07-2025, 09:56:31 PM
System Manufacturer:       ASUSTeK COMPUTER INC.
System Model:              ASUS TUF Gaming A15 FA506IHRB_FA506IHRZ
System Type:               x64-based PC
Processor(s):               1 Processor(s) Installed.
                           [01]: AMD64 Family 23 Model 96 Stepping 1 AuthenticAMD ~3001 Mhz
BIOS Version:              American Megatrends Inc. FA506IHRB.307, 28-12-2022
Windows Directory:         C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:                \Device\HarddiskVolume1
```

```
C:\Users\karan>systeminfo /s Karan

Host Name:                KARAN
OS Name:                  Microsoft Windows 11 Home Single Language
OS Version:               10.0.26100 N/A Build 26100
OS Manufacturer:         Microsoft Corporation
OS Configuration:        Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:         karan08338@outlook.com
Registered Organization:   N/A
Product ID:                00342-42630-23808-AAOEM
Original Install Date:     09-04-2025, 01:23:26 PM
System Boot Time:          03-07-2025, 09:56:31 PM
System Manufacturer:       ASUSTeK COMPUTER INC.
System Model:              ASUS TUF Gaming A15 FA506IHRB_FA506IHRZ
System Type:               x64-based PC
Processor(s):               1 Processor(s) Installed.
                           [01]: AMD64 Family 23 Model 96 Stepping 1 AuthenticAMD ~3001 Mhz
BIOS Version:              American Megatrends Inc. FA506IHRB.307, 28-12-2022
Windows Directory:         C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:                \Device\HarddiskVolume1
System Locale:              en-us;English (United States)
Input Locale:               00004009
Time Zone:                  (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
```



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```
C:\Users\karan>systeminfo /fo table
```

Host Name	OS Name	OS Version	OS Manufacturer
OS Configuration	OS Build Type	Registered Owner	
Registered Organization	Product ID	Original Install Date	System
System Boot Time	System Manufacturer	System Model	System Type
BIOS Version	Windows Directory	System Directory	Boot Device
System Locale	Input Locale	Time Zone	
Total Physical Memory	Available Physical Memory	Virtual Memory: Max Size	Virtual Memory: Avail
Table Virtual Memory: In Use	Page File Location(s)	Domain	Logon Server
Network Card(s)			Hotfix(s)
n-based security			Virtualization
			Hyper-V Requirements
=====			
=====			
=====			
=====			
=====			
=====			
=====			
=====			
=====			
KARAN	Microsoft Windows 11 Home Sing	10.0.26100 N/A Build 26100	Microsoft Corporation



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5. tracert

Description:

Tracert command (short for trace route) is a Windows command-line tool used to trace the path that packets take from your computer to a destination host (like a website or IP address).

No.	Option	Description
1	tacert	Diagnose where delays or failures occur in a network path.
2	tacert -d	Do not resolve IP addresses to hostnames (faster).
3	tacert -h max	Set the max number of hops to search (default is 30).
4	tacert -4 google.com	Ipv4 Terminal ipaddress

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>tracert darshan.ac.in

Tracing route to darshan.ac.in [103.13.112.180]
over a maximum of 30 hops:

  1  *          *          1010 ms  10.20.1.1
  2  44 ms      5 ms       10 ms   103.70.32.145
  3  *          6 ms       6 ms    10.1.252.37
  4  23 ms      26 ms      36 ms   103.156.182.82
  5  *          *          26 ms    103.77.108.5
  6  22 ms      23 ms      21 ms   darshan.interactivedns.com [103.13.112.180]

Trace complete.
```



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```
C:\Users\karan>tracert -d google.com
```

```
Tracing route to google.com [2607:f8b0:4002:c09::71]  
over a maximum of 30 hops:
```

1	*	*	*	Request timed out.
2	3 ms	2 ms	2 ms	2402:a00:182:1::1111
3	3 ms	3 ms	3 ms	2402:a00:80::1001
4	20 ms	20 ms	20 ms	2402:a00:80::2e
5	20 ms	20 ms	20 ms	2404:6800:81e1:1c0::1
6	21 ms	20 ms	20 ms	2404:6800:81e1:1c0::1
7	*	*	21 ms	2001:4860:0:1::5500
8	22 ms	20 ms	21 ms	2001:4860:0:1::77ae
9	292 ms	292 ms	292 ms	2001:4860::9:4001:163c
10	292 ms	296 ms	293 ms	2001:4860::c:4003:1caf
11	298 ms	290 ms	294 ms	2001:4860::c:4002:f3e0
12	*	*	*	Request timed out.
13	292 ms	293 ms	293 ms	2001:4860::c:4003:1cbd
14	292 ms	302 ms	292 ms	2001:4860::c:4002:74b3
15	293 ms	292 ms	291 ms	2001:4860::c:4003:cf35
16	292 ms	293 ms	293 ms	2001:4860::c:4002:8e38
17	*	*	*	Request timed out.
18	*	*	*	Request timed out.
19	*	*	*	Request timed out.
20	289 ms	290 ms	289 ms	2607:f8b0:4002:c09::71

Trace complete.

```
C:\Users\karan>tracert -h 10 darshan.ac.in
```

```
Tracing route to darshan.ac.in [103.13.112.180]  
over a maximum of 10 hops:
```

1	2 ms	3 ms	2 ms	gpon.net [192.168.1.1]
2	3 ms	3 ms	3 ms	182.237.14.17
3	4 ms	4 ms	8 ms	10.244.21.1 [10.244.21.1]
4	16 ms	16 ms	15 ms	103.241.47.61
5	31 ms	18 ms	17 ms	103.77.108.5
6	16 ms	17 ms	15 ms	darshan.interactivedns.com [103.13.112.180]

Trace complete.

```
C:\Users\karan>tracert -4 google.com
```

```
Tracing route to google.com [142.251.42.78]  
over a maximum of 30 hops:
```

1	2 ms	2 ms	1 ms	gpon.net [192.168.1.1]
2	3 ms	3 ms	3 ms	182.237.14.17
3	4 ms	4 ms	4 ms	10.244.21.1 [10.244.21.1]
4	16 ms	15 ms	15 ms	103.241.47.61
5	16 ms	16 ms	16 ms	142.250.47.236
6	17 ms	16 ms	16 ms	72.14.238.215
7	15 ms	16 ms	15 ms	142.251.69.105
8	15 ms	15 ms	15 ms	bom12s21-in-f14.1e100.net [142.251.42.78]

Trace complete.

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6. netstat

Description:

The netstat command is a powerful network utility that displays network connections, routing tables, interface statistics, and more. It's available on Windows, Linux, and macOS.

No.	Option	Description
1	netstat	By default, it shows active TCP connections.
2	netstat -a	Show all active connections and listening ports.
3	netstat -r	Display the routing table.
4	netstat -s	Show per-protocol statistics.
5	netstat -e	Show Ethernet statistics

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>netstat

Active Connections

Proto Local Address           Foreign Address         State
TCP    10.20.65.16:49450        4.213.25.242:https      ESTABLISHED
TCP    10.20.65.16:49740        20.189.173.24:https     TIME_WAIT
TCP    10.20.65.16:49743        20.190.146.35:https     TIME_WAIT
TCP    10.20.65.16:49744        dns:https               ESTABLISHED
TCP    10.20.65.16:65472        4.213.25.242:https      ESTABLISHED
TCP    10.20.65.16:65486        sf-in-f188:5228         ESTABLISHED
TCP    127.0.0.1:1042           Karan:64732             ESTABLISHED
TCP    127.0.0.1:1042           Karan:64734             ESTABLISHED
TCP    127.0.0.1:9012           Karan:64711             ESTABLISHED
TCP    127.0.0.1:13030         Karan:49669             ESTABLISHED
TCP    127.0.0.1:49669         Karan:13030             ESTABLISHED
TCP    127.0.0.1:50100         Karan:64710             ESTABLISHED
TCP    127.0.0.1:64710         Karan:50100             ESTABLISHED
TCP    127.0.0.1:64711         Karan:9012              ESTABLISHED
TCP    127.0.0.1:64732         Karan:1042              ESTABLISHED
TCP    127.0.0.1:64734         Karan:1042              ESTABLISHED
```



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```
C:\Users\karan>netstat -a
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	0.0.0.0:135	Karan:0	LISTENING
TCP	0.0.0.0:445	Karan:0	LISTENING
TCP	0.0.0.0:5040	Karan:0	LISTENING
TCP	0.0.0.0:9012	Karan:0	LISTENING
TCP	0.0.0.0:9013	Karan:0	LISTENING
TCP	0.0.0.0:49664	Karan:0	LISTENING
TCP	0.0.0.0:49665	Karan:0	LISTENING
TCP	0.0.0.0:49666	Karan:0	LISTENING
TCP	0.0.0.0:49667	Karan:0	LISTENING
TCP	0.0.0.0:49668	Karan:0	LISTENING
TCP	0.0.0.0:49670	Karan:0	LISTENING
TCP	0.0.0.0:57621	Karan:0	LISTENING
TCP	0.0.0.0:61602	Karan:0	LISTENING
TCP	127.0.0.1:1042	Karan:0	LISTENING
TCP	127.0.0.1:1042	Karan:61571	ESTABLISHED
TCP	127.0.0.1:1042	Karan:61573	ESTABLISHED
TCP	127.0.0.1:1043	Karan:0	LISTENING
TCP	127.0.0.1:7768	Karan:0	LISTENING
TCP	127.0.0.1:7778	Karan:0	LISTENING

```
C:\Users\karan>netstat -e
```

Interface Statistics

	Received	Sent
Bytes	187383930	53782662
Unicast packets	275100	235806
Non-unicast packets	6390	3738
Discards	0	0
Errors	0	0
Unknown protocols	0	0

```
C:\Users\karan>netstat -r
```

Interface List

```
9...a0 36 bc 26 30 .....Realtek PCIe GbE Family Controller
11...52 5a 65 03 ef a9 .....Microsoft Wi-Fi Direct Virtual Adapter
7...52 5a 65 03 ef b9 .....Microsoft Wi-Fi Direct Virtual Adapter #2
5...50 5a 65 03 ef 99 .....MediaTek Wi-Fi 6 MT7921 Wireless LAN Card
1.....Software Loopback Interface 1
```

IPv4 Route Table

Active Routes:

Network	Destination	Netmask	Gateway	Interface	Metric
	0.0.0.0	0.0.0.0	192.168.121.253	192.168.121.154	50
	127.0.0.0	255.0.0.0	On-link	127.0.0.1	331
	127.0.0.1	255.255.255.255	On-link	127.0.0.1	331
127.255.255.255	255.255.255.255	255.255.255.255	On-link	127.0.0.1	331
	192.168.121.0	255.255.255.0	On-link	192.168.121.154	306
192.168.121.154	255.255.255.255	255.255.255.255	On-link	192.168.121.154	306
192.168.121.255	255.255.255.255	255.255.255.255	On-link	192.168.121.154	306
	224.0.0.0	240.0.0.0	On-link	127.0.0.1	331
	224.0.0.0	240.0.0.0	On-link	192.168.121.154	306
255.255.255.255	255.255.255.255	255.255.255.255	On-link	127.0.0.1	331
255.255.255.255	255.255.255.255	255.255.255.255	On-link	192.168.121.154	306



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```
C:\Users\karan>netstat -s
```

IPv4 Statistics

Packets Received	= 597547
Received Header Errors	= 268
Received Address Errors	= 457
Datagrams Forwarded	= 0
Unknown Protocols Received	= 0
Received Packets Discarded	= 171528
Received Packets Delivered	= 574590
Output Requests	= 256068
Routing Discards	= 0
Discarded Output Packets	= 96
Output Packet No Route	= 42
Reassembly Required	= 199
Reassembly Successful	= 99
Reassembly Failures	= 0
Datagrams Successfully Fragmented	= 0
Datagrams Failing Fragmentation	= 0
Fragments Created	= 0

IPv6 Statistics

Packets Received	= 547304
Received Header Errors	= 0
Received Address Errors	= 26
Datagrams Forwarded	= 0
Unknown Protocols Received	= 1



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7. nslookup

Description:

The nslookup command is a network tool used to query Domain Name System (DNS) servers. It helps you find the IP address associated with a domain name or vice versa.

No.	Option	Description
1	nslookup	Starts interactive mode where you can type multiple queries.
2	server DNS server	Use a specific DNS server for queries
3	set type=[record type]	Query specific DNS record types

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>nslookup darshan.ac.in
Server: UnKnown
Address: 10.20.1.1

Non-authoritative answer:
Name: darshan.ac.in
Address: 103.13.112.180
```

```
C:\Users\karan>nslookup -type=NS google.com
Server: UnKnown
Address: 192.168.121.253

Non-authoritative answer:
google.com      nameserver = ns3.google.com
google.com      nameserver = ns4.google.com
google.com      nameserver = ns1.google.com
google.com      nameserver = ns2.google.com

ns2.google.com  internet address = 216.239.34.10
ns2.google.com  AAAA IPv6 address = 2001:4860:4802:34::a
ns3.google.com  internet address = 216.239.36.10
ns3.google.com  AAAA IPv6 address = 2001:4860:4802:36::a
ns4.google.com  internet address = 216.239.38.10
ns4.google.com  AAAA IPv6 address = 2001:4860:4802:38::a
ns1.google.com  internet address = 216.239.32.10
ns1.google.com  AAAA IPv6 address = 2001:4860:4802:32::a
```



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```
C:\Users\karan>nslookup google.com 8.8.8.8
Server:  dns.google
Address:  8.8.8.8

Non-authoritative answer:
Name:     google.com
Addresses: 2404:6800:4009:800::200e
          142.250.70.46
```

8. hostname

Description:

The hostname command is a simple utility used to display or set the hostname of a computer.

No.	Option	Description
1	hostname	This displays the name of the computer (its network name).

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>hostname
Karan
```



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9. pathping

Description:

The pathping command is a Windows command-line utility that combines the functionality of ping and tracert (trace route).

No.	Option	Description
1	pathping -n	Don't resolve hostnames (show only IPs — faster).
2	pathping -h max	Maximum number of hops to search
3.	pathping -g hostlist	Loose source route along the given hosts.
4.	pathping -p period	Wait time (in ms) between pings (default is 250 ms).
5.	pathping -q 5	Number of queries per hop (default is 100).

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----



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```
C:\Users\karan>pathping -n
A target name or address must be specified.

Usage: pathping [-g host-list] [-h maximum_hops] [-i address] [-n]
               [-p period] [-q num_queries] [-w timeout]
               [-4] [-6] target_name

Options:
  -g host-list      Loose source route along host-list.
  -h maximum_hops   Maximum number of hops to search for target.
  -i address        Use the specified source address.
  -n                Do not resolve addresses to hostnames.
  -p period         Wait period milliseconds between pings.
  -q num_queries    Number of queries per hop.
  -w timeout        Wait timeout milliseconds for each reply.
  -4                Force using IPv4.
  -6                Force using IPv6.
```

```
C:\Users\karan>pathping -h 20 google.com

Tracing route to google.com [2404:6800:4009:827::200e]
over a maximum of 20 hops:
  0  Karan [2409:40c1:318d:abc3:34b9:5e66:9c16:f9be]
  1  2409:40c1:318d:abc3::e1
  2  2405:200:5210:5:3924:110:3:505
  3  * * *
Computing statistics for 50 seconds...
```

```
C:\Users\karan>pathping -g 192.168.1.1 10.0.0.1 google.com

Tracing route to google.com [142.250.207.142]
over a maximum of 30 hops:
  0  Karan [192.168.121.154]
  1  * * *
Computing statistics for 0 seconds...
Hop  RTT      Source to Here   This Node/Link   Address
  0                               Lost/Sent = Pct  Lost/Sent = Pct  Karan [192.168.121.154]

Trace complete.
```



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```
C:\Users\karan>pathping -p 500 google.com

Tracing route to google.com [2404:6800:4009:82a::200e]
over a maximum of 30 hops:
  0  Karan [2409:40c1:318d:abc3:34b9:5e66:9c16:f9be]
  1  2409:40c1:318d:abc3::e1
  2  2405:200:5210:5:3924:110:3:505
  3  * * *
Computing statistics for 100 seconds...
```

```
C:\Users\karan>pathping -q 5
A target name or address must be specified.

Usage: pathping [-g host-list] [-h maximum_hops] [-i address] [-n]
               [-p period] [-q num_queries] [-w timeout]
               [-4] [-6] target_name

Options:
  -g host-list      Loose source route along host-list.
  -h maximum_hops   Maximum number of hops to search for target.
  -i address        Use the specified source address.
  -n               Do not resolve addresses to hostnames.
  -p period         Wait period milliseconds between pings.
  -q num_queries    Number of queries per hop.
  -w timeout        Wait timeout milliseconds for each reply.
  -4               Force using IPv4.
  -6               Force using IPv6.
```

10.arp

Description:

The arp command is used to view and manage the ARP (Address Resolution Protocol) cache, which maps IP addresses to MAC (physical) addresses on a local network.

No.	Option	Description
-----	--------	-------------



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1	-a	Displays the current ARP entries
2	-g	Same as globally
3.	-d ipaddress	Deletes the ARP entry for the specified IP address
4.	-s ipadress mac address	Adds a static ARP entry

Implementation:

----- Screenshot Only (Execute command on command prompt / terminal) -----

```
C:\Users\karan>arp -a
Interface: 10.20.65.16 --- 0x5
Internet Address      Physical Address      Type
10.20.1.1             7c-5a-1c-ce-2f-57    dynamic
10.20.11.13           60-ff-9e-1e-3c-54    dynamic
10.20.32.22           cc-47-40-d7-e6-17    dynamic
10.20.38.26           60-ff-9e-1e-3d-1a    dynamic
10.20.64.81           f4-6d-3f-29-e6-9f    dynamic
10.20.64.178          68-7a-64-d3-b9-6d    dynamic
10.20.64.238          e4-0d-36-9f-d0-26    dynamic
10.20.255.255         ff-ff-ff-ff-ff-ff    static
224.0.0.2             01-00-5e-00-00-02    static
224.0.0.22            01-00-5e-00-00-16    static
224.0.0.251           01-00-5e-00-00-fb    static
224.0.0.252           01-00-5e-00-00-fc    static
239.255.255.250       01-00-5e-7f-ff-fa    static
255.255.255.255       ff-ff-ff-ff-ff-ff    static
```

```
C:\Users\karan>arp -d
The ARP entry deletion failed: The requested operation requires elevation.
```



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```
C:\Users\karan>arp -s
```

Displays and modifies the IP-to-Physical address translation tables used by address resolution protocol (ARP).

```
ARP -s inet_addr eth_addr [if_addr]
```

```
ARP -d inet_addr [if_addr]
```

```
ARP -a [inet_addr] [-N if_addr] [-v]
```

-a Displays current ARP entries by interrogating the current protocol data. If **inet_addr** is specified, the IP and Physical addresses for only the specified computer are displayed. If more than one network interface uses ARP, entries for each ARP table are displayed.

-g Same as **-a**.

-v Displays current ARP entries in verbose mode. All invalid entries and entries on the loop-back interface will be shown.

inet_addr Specifies an internet address.

-N if_addr Displays the ARP entries for the network interface specified by **if_addr**.

-d Deletes the host specified by **inet_addr**. **inet_addr** may be wildcarded with ***** to delete all hosts.

-s Adds the host and associates the Internet address **inet_addr** with the Physical address **eth_addr**. The Physical address is given as 6 hexadecimal bytes separated by hyphens. The entry is permanent.

eth_addr Specifies a physical address.

if_addr If present, this specifies the Internet address of the interface whose address translation table should be modified.

```
C:\Users\karan>arp -g
```

Interface: 192.168.1.2 --- 0x5

Internet Address	Physical Address	Type
192.168.1.1	c0-94-ad-d2-9a-38	dynamic
192.168.1.6	bc-45-5b-d1-ff-46	dynamic
192.168.1.255	ff-ff-ff-ff-ff-ff	static
224.0.0.22	01-00-5e-00-00-16	static
224.0.0.251	01-00-5e-00-00-fb	static
224.0.0.252	01-00-5e-00-00-fc	static
239.255.255.250	01-00-5e-7f-ff-fa	static
255.255.255.255	ff-ff-ff-ff-ff-ff	static