Date: / /

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-6B-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. . . . . . . . . : 50-5A-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-47-2E-99-A0-36-BC-6B-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     Syste
m Boot Time                  System Manufacturer           System Model         System Type               Processor(s)
                              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: Ava:
lable Virtual Memory: In Use     Page File Location(s)         Domain                Logon Server         Hotfix(s)
      Network Card(s)                                                                                      Virtualizati
n-based security                                                                         Hyper-V Requirements

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KARAN                          Microsoft Windows 11 Home Sing 10.0.26100 N/A Build 26100     Microsoft Corporation
```

Date: / /

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
```

```
C:\Users\karan>netstat -r
===========================================================================
Interface List
  9...a0 36 bc 6b 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         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         On-link   192.168.121.154    306
  192.168.121.255  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         On-link         127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link   192.168.121.154    306
```

Date: / /

```
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
```

Date: / /

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
```

Date: / /

```
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
```

Date: / /

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) -----

Date: / /

```
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...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           Karan [192.168.121.154]

Trace complete.
```

Date: / /

```
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

Date: / /

1	-a	Displays the current ARP entries
2	-g	Same as globaly
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.
```

Date: / /

```
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
```