Date: 20/07/2025

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:

No.	Option	Description
1	ipconfig	Displays basic IP configuration for all adapters.
2	ipconfig /all	Shows detailed IP settings, including MAC address and DHCP info.
3	ipconfig /release	Releases current IP address from DHCP server.
4	ipconfig /renew	Renews the IP address from DHCP server.
5	ipconfig /flushdns	Clears DNS cache on your system.

Implementation:

1 ipconfig

```
C:\Users\Nikhil>ipconfig

Windows IP Configuration


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  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7
   IPv4 Address. . . . . . . . . . . : 192.168.189.140
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7
                                       192.168.189.63

C:\Users\Nikhil>
```

2 ipconfig /all

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

Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-A45M567
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Mixed
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : F0-77-C3-F8-B3-B8
   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. . . . . . . . . : F2-77-C3-F8-B3-B7
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) Wireless-AC 9560
   Physical Address. . . . . . . . . : F0-77-C3-F8-B3-B7
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd(Preferred)
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0(Preferred)
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.189.140(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 23 July 2025 5.01.57 PM
   Lease Expires . . . . . . . . . . : 23 July 2025 6.01.56 PM
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7
                                       192.168.189.63
   DHCP Server . . . . . . . . . . . : 192.168.189.63
   DHCPv6 IAID . . . . . . . . . . . : 116422595
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2C-26-48-35-F0-77-C3-F8-B3-B7
   DNS Servers . . . . . . . . . . . : 192.168.189.63
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

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3 ipconfig /releasell

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

Windows IP Configuration

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.

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  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7

C:\Users\Nikhil>
```

4 ipconfig /renew

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

Windows IP Configuration

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.

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  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
   Temporary IPv6 Address. . . . . . : 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
   Link-local IPv6 Address . . . . . : fe80::38a8:deff:cc7a:4f46%7
   IPv4 Address. . . . . . . . . . . : 192.168.189.140
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::dc38:fdff:fe48:aa6%7
                                       192.168.189.63

C:\Users\Nikhil>
```

5. ipconfig /flushdns

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

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

C:\Users\Nikhil>
```

2. ping
Description:

No.	Option	Description
1	ping	Sends ICMP Echo Request to test connectivity.
2	ping [hostname]	Checks reachability of a host (e.g., ping google.com).
3	ping [IP]	Tests a specific IP (e.g., ping 8.8.8.8).
4	ping -n [count]	Sends a specific number of echo requests (e.g., ping -n 5 google.com)
5	ping -t [host]	Pings the target continuously until stopped.

Implementation:

1. ping google.com

```
C:\Users\Nikhil>ping google.com

Pinging google.com [2404:6800:4009:82b::200e] with 32 bytes of data:
Reply from 2404:6800:4009:82b::200e: time=96ms
Reply from 2404:6800:4009:82b::200e: time=108ms
Reply from 2404:6800:4009:82b::200e: time=125ms
Reply from 2404:6800:4009:82b::200e: time=93ms

Ping statistics for 2404:6800:4009:82b::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 93ms, Maximum = 125ms, Average = 105ms

C:\Users\Nikhil>
```

2. ping 8.8.8.8

```
C:\Users\Nikhil>ping 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=111ms TTL=113
Reply from 8.8.8.8: bytes=32 time=81ms TTL=113
Reply from 8.8.8.8: bytes=32 time=75ms TTL=113
Reply from 8.8.8.8: bytes=32 time=76ms TTL=113

Ping statistics for 8.8.8.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 75ms, Maximum = 111ms, Average = 85ms

C:\Users\Nikhil>
```

3. ping -n 5 google.com

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

Pinging google.com [2404:6800:4009:828::200e] with 32 bytes of data:
Reply from 2404:6800:4009:828::200e: time=62ms
Reply from 2404:6800:4009:828::200e: time=73ms
Reply from 2404:6800:4009:828::200e: time=81ms
Reply from 2404:6800:4009:828::200e: time=70ms
Reply from 2404:6800:4009:828::200e: time=62ms

Ping statistics for 2404:6800:4009:828::200e:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 62ms, Maximum = 81ms, Average = 69ms

C:\Users\Nikhil>
```

4. ping -t 8.8.8.8

```
C:\Users\Nikhil>ping -t 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=119ms TTL=113
Reply from 8.8.8.8: bytes=32 time=82ms TTL=113
Reply from 8.8.8.8: bytes=32 time=74ms TTL=113
Reply from 8.8.8.8: bytes=32 time=68ms TTL=113
Reply from 8.8.8.8: bytes=32 time=72ms TTL=113
Reply from 8.8.8.8: bytes=32 time=73ms TTL=113
Reply from 8.8.8.8: bytes=32 time=86ms TTL=113
Reply from 8.8.8.8: bytes=32 time=72ms TTL=113
```

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3. getmac

Description:

No.	Option	Description
1	getmac	Displays MAC address of the computer.
2	getmac /v	Shows detailed output with connection names.
3	getmac /fo list	Outputs MAC in list format.

Implementation:

1. getmac

```
C:\Users\Nikhil>getmac

Physical Address     Transport Name
=================== ========================================================
F0-77-C3-F8-B3-B7    \Device\Tcpip_{4838DBAC-5E6A-42EE-9EEE-4AB21659358A}

C:\Users\Nikhil>
```

2. getmac /v

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

Connection Name Network Adapter Physical Address    Transport Name
=============== =============== =================== =========================================================
Wi-Fi           Intel(R) Wirele F0-77-C3-F8-B3-B7    \Device\Tcpip_{4838DBAC-5E6A-42EE-9EEE-4AB21659358A}

C:\Users\Nikhil>
```

3. getmac /fo list

```
C:\Users\Nikhil>getmac /fo list

Physical Address: F0-77-C3-F8-B3-B7
Transport Name:   \Device\Tcpip_{4838DBAC-5E6A-42EE-9EEE-4AB21659358A}

C:\Users\Nikhil>
```

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4. systeminfo

Description:

No.	Option	Description
1	Systeminfo	Displays detailed system configuration.
2	`systeminfo "Host"`	findstr "Host"`
3	`systeminfo "OS"`	findstr "OS"`

Implementation:

1. systeminfo

```
C:\Users\Nikhil>systeminfo

Host Name:                 DESKTOP-A45M567
OS Name:                   Microsoft Windows 11 Home Single Language
OS Version:                10.0.22631 N/A Build 22631
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          Nikhil
Registered Organization:
Product ID:                00327-36297-42854-AAOEM
Original Install Date:     22-06-2023, 11.40.33 PM
System Boot Time:          23-07-2025, 4.58.45 PM
System Manufacturer:       LENOVO
System Model:              81WB
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 142 Stepping 12 GenuineIntel ~2093 Mhz
BIOS Version:              LENOVO DXCN45WW, 13-06-2023
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
Total Physical Memory:     8,026 MB
Available Physical Memory: 2,691 MB
Virtual Memory: Max Size:  13,658 MB
Virtual Memory: Available: 6,925 MB
Virtual Memory: In Use:    6,733 MB
Page File Location(s):     D:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\DESKTOP-A45M567
Hotfix(s):                 5 Hotfix(s) Installed.
                           [01]: KB5054980
                           [02]: KB5012170
                           [03]: KB5027397
                           [04]: KB5058405
                           [05]: KB5058528
Network Card(s):           1 NIC(s) Installed.
                           [01]: Intel(R) Wireless-AC 9560
                                 Connection Name: Wi-Fi
                                 DHCP Enabled:    Yes
                                 DHCP Server:     192.168.189.63
                                 IP address(es)
                                 [01]: 192.168.189.140
                                 [02]: fe80::38a8:deff:cc7a:4f46
                                 [03]: 2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0
                                 [04]: 2409:40c1:3033:cdc9:26c2:3a15:aa34:9cbd
Hyper-V Requirements:      A hypervisor has been detected. Features required for Hyper-V will not be displayed.
```

2 /3 .

systeminfo | findstr "Host"

systeminfo | findstr "OS"

```
C:\Users\Nikhil>systeminfo | findstr "Host"
Host Name:                 DESKTOP-A45M567

C:\Users\Nikhil>systeminfo | findstr "OS"
OS Name:                   Microsoft Windows 11 Home Single Language
OS Version:                10.0.22631 N/A Build 22631
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
BIOS Version:              LENOVO DXCN45WW, 13-06-2023

C:\Users\Nikhil>
```

5. traceroute / tracert
Description:

No.	Option	Description
1	tracert google.com	Shows route taken to reach google.com.
2	tracert -d	Doesn't resolve hostnames (shows IPs only).
3	tracert -h 5	Limits max number of hops to 5.

Implementation:

1. tracert google.com

```
C:\Users\Nikhil>tracert google.com

Tracing route to google.com [2404:6800:4009:82b::200e]
over a maximum of 30 hops:

  1     3 ms     2 ms     3 ms  2409:40c1:3033:cdc9::b7
  2    41 ms    56 ms    39 ms  2405:200:5210:5:3924:110:3:206
  3    57 ms    49 ms    48 ms  2405:200:5210:5:3925::1
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6   987 ms   932 ms   508 ms  2405:200:801:2e00::84
  7     *        *        *     Request timed out.
  8     *        *        *     Request timed out.
  9   169 ms   143 ms   574 ms  2404:6800:81e1:2c0::1
 10   110 ms   122 ms   138 ms  2404:6800:81e1:2c0::1
 11   123 ms    90 ms   107 ms  2404:6800:81e1:2c0::1
 12   103 ms    99 ms    99 ms  2001:4860:0:1::5e60
 13   105 ms    97 ms   100 ms  2001:4860:0:1::77ae
 14   130 ms    98 ms   109 ms  2001:4860::c:4004:172c
 15   121 ms   123 ms   119 ms  2001:4860::9:4000:d773
 16    92 ms   110 ms    98 ms  2001:4860:0:1::3129
 17   110 ms   129 ms   107 ms  bom12s18-in-x0e.1e100.net [2404:6800:4009:82b::200e]

Trace complete.

C:\Users\Nikhil>
```

2. tracert -d google.com

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

Tracing route to google.com [2404:6800:4009:82f::200e]
over a maximum of 30 hops:

  1     4 ms     2 ms     2 ms  2409:40c1:3033:cdc9::b7
  2    86 ms    53 ms    52 ms  2405:200:5210:5:3924:110:3:206
  3    58 ms    40 ms    48 ms  2405:200:5210:5:3925::1
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6   165 ms   100 ms   107 ms  2405:200:801:2e00::86
  7     *        *        *     Request timed out.
  8     *        *        *     Request timed out.
  9    75 ms    55 ms    77 ms  2404:6800:8281:c0::1
 10    86 ms    54 ms    78 ms  2404:6800:8281:c0::1
 11    87 ms    57 ms    58 ms  2001:4860:0:1::7ba6
 12   149 ms    68 ms    78 ms  2001:4860:0:1::87b2
 13    76 ms    78 ms   140 ms  2001:4860:0:1::8769
 14    75 ms    72 ms    81 ms  2001:4860:0:1::3ff
 15    80 ms    57 ms    59 ms  2404:6800:4009:82f::200e

Trace complete.

C:\Users\Nikhil>
```

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3. tracert -d google.com

```
C:\Users\Nikhil>tracert -h 5 google.com

Tracing route to google.com [2404:6800:4009:810::200e]
over a maximum of 5 hops:

  1     5 ms     4 ms     2 ms  2409:40c1:3033:cdc9::b7
  2    65 ms    74 ms    98 ms  2405:200:5210:5:3924:110:3:206
  3    83 ms    67 ms    82 ms  2405:200:5210:5:3925::1
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.

Trace complete.

C:\Users\Nikhil>
```

6. netstat
Description:

No.	Option	Description
1	netstat	Shows route taken to reach google.com.
2	netstat -a	Doesn't resolve hostnames (shows IPs only).
3	netstat -n	Limits max number of hops to 5.

Implementation:

1. netstat

```
C:\Users\Nikhil>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:61100        DESKTOP-A45M567:49350  SYN_SENT
  TCP    192.168.189.140:61037  whatsapp-cdn-shv-01-pnq1:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60618  relay-800db3bd:https   ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60628  [2603:1040:a06:6::2]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60632  sf-in-f188:5228          ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60702  [2606:4700:8ca2:7cbc:c2d9:ae5:5ff2:75c4]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60849  [2620:1ec:bdf::254]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60850  [2620:1ec:bdf::48]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60854  g2600-140f-7200-003c-0000-0000-17d4-00c5:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60970  bom12s13-in-x03:https  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61093  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61094  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61101  [64:ff9b::34b6:8fd7]:https  ESTABLISHED

C:\Users\Nikhil>
```

2. netstat -a

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

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:80             DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:135            DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:443            DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:445            DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:3306           DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:5040           DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:7070           DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49664          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49665          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49666          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49667          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49668          DESKTOP-A45M567:0      LISTENING
  TCP    0.0.0.0:49670          DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:1001         DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:27017        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:28385        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:28390        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:49351        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:49677        DESKTOP-A45M567:0      LISTENING
  TCP    127.0.0.1:61129        DESKTOP-A45M567:49350  SYN_SENT
  TCP    192.168.189.140:139    DESKTOP-A45M567:0      LISTENING
  TCP    192.168.189.140:61109  whatsapp-cdn-shv-04-bom2:https  ESTABLISHED
  TCP    192.168.189.140:61110  whatsapp-cdn-shv-02-bom1:https  ESTABLISHED
  TCP    192.168.189.140:61111  whatsapp-cdn-shv-01-pnq1:https  ESTABLISHED
  TCP    192.168.189.140:61112  whatsapp-cdn-shv-01-bom1:https  ESTABLISHED
  TCP    192.168.189.140:61113  whatsapp-cdn-shv-02-pnq1:https  ESTABLISHED
  TCP    192.168.189.140:61114  whatsapp-cdn-shv-02-bom2:https  ESTABLISHED
  TCP    192.168.189.140:61115  whatsapp-cdn-shv-01-bom2:https  ESTABLISHED
  TCP    192.168.189.140:61116  whatsapp-cdn-shv-01-hyd1:https  ESTABLISHED
  TCP    192.168.189.140:61117  whatsapp-cdn-shv-03-bom2:https  ESTABLISHED
  TCP    [::]:80                DESKTOP-A45M567:0      LISTENING
  TCP    [::]:135               DESKTOP-A45M567:0      LISTENING
  TCP    [::]:443               DESKTOP-A45M567:0      LISTENING
  TCP    [::]:445               DESKTOP-A45M567:0      LISTENING
  TCP    [::]:3306              DESKTOP-A45M567:0      LISTENING
  TCP    [::]:7070              DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49664             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49665             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49666             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49667             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49668             DESKTOP-A45M567:0      LISTENING
  TCP    [::]:49670             DESKTOP-A45M567:0      LISTENING
  TCP    [::1]:49669            DESKTOP-A45M567:0      LISTENING
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60618  relay-800db3bd:https   ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60628  [2603:1040:a06:6::2]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60632  sf-in-f188:5228            ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60702  [2606:4700:8ca2:7cbc:c2d9:ae5:5ff2:75c4]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60849  [2620:1ec:bdf::254]:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60850  [2620:1ec:bdf::48]:https   CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60854  g2600-140f-7200-003c-0000-0000-17d4-00c5:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61093  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61094  [2405:200:1630:1896::40dc]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61101  [64:ff9b::34b6:8fd7]:https  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61103  pnbomb-bk-in-x04:https  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61108  whatsapp-chatd-edge6-shv-01-hyd1:http  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61122  [2603:1046:1406::5]:https  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61123  [2603:1046:1406::5]:https  TIME_WAIT
  UDP    0.0.0.0:5050           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5355           *:*
  UDP    0.0.0.0:50001          *:*
  UDP    0.0.0.0:52753          *:*
  UDP    127.0.0.1:1900         *:*
  UDP    127.0.0.1:49664        127.0.0.1:49664
  UDP    127.0.0.1:61591        *:*
  UDP    192.168.189.140:137    *:*
  UDP    192.168.189.140:138    *:*
  UDP    192.168.189.140:1900   *:*
  UDP    192.168.189.140:61590  *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5355              *:*
```

3. netstat -n

```
C:\Users\Nikhil>netstat -n

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:61145        127.0.0.1:49350        SYN_SENT
  TCP    192.168.189.140:61111  157.240.242.60:443     ESTABLISHED
  TCP    192.168.189.140:61115  163.70.143.60:443      TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60618  [64:ff9b::9471:146d]:443  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60628  [2603:1040:a06:6::2]:443  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60632  [2404:6800:4003:c03::bc]:5228  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60702  [2606:4700:8ca2:7cbc:c2d9:ae5:5ff2:75c4]:443  ESTABLISHED
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60849  [2620:1ec:bdf::254]:443  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60850  [2620:1ec:bdf::48]:443  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:60854  [2600:140f:7200:3c::17d4:c5]:443  CLOSE_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61101  [64:ff9b::34b6:8fd7]:443  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61108  [2a03:2880:f285:c8:face:b00c:0:7260]:80  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61122  [2603:1046:1406::5]:443  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61123  [2603:1046:1406::5]:443  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61132  [2a03:2880:f285:c8:face:b00c:0:7260]:80  TIME_WAIT
  TCP    [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]:61141  [2404:6800:4009:80d::2004]:443  ESTABLISHED

C:\Users\Nikhil>
```

7. nslookup

Description:

No.	Option	Description
1	nslookup	Starts interactive mode for DNS queries..
2	nslookup google.com	Queries DNS for IP of google.com.
3	nslookup -type=MX gmail.com	Queries mail servers of gmail.com.

Implementation:

1. nslookup

```
C:\Users\Nikhil>nslookup
DNS request timed out.
    timeout was 2 seconds.
Default Server:  UnKnown
Address:  192.168.189.63
```

2. nslookup

```
C:\Users\Nikhil>nslookup google.com
Server:  UnKnown
Address:  192.168.189.63

Non-authoritative answer:
Name:    google.com
Addresses:  2404:6800:4009:810::200e
          142.250.70.46


C:\Users\Nikhil>
```

3. nslookup -type=MX gmail.com

```
C:\Users\Nikhil>nslookup -type=MX gmail.com
Server:  UnKnown
Address:  192.168.189.63

Non-authoritative answer:
gmail.com       MX preference = 5, mail exchanger = gmail-smtp-in.l.google.com
gmail.com       MX preference = 10, mail exchanger = alt1.gmail-smtp-in.l.google.com
gmail.com       MX preference = 20, mail exchanger = alt2.gmail-smtp-in.l.google.com
gmail.com       MX preference = 40, mail exchanger = alt4.gmail-smtp-in.l.google.com
gmail.com       MX preference = 30, mail exchanger = alt3.gmail-smtp-in.l.google.com

C:\Users\Nikhil>
```

8. hostname
Description:

No.	Option	Description
1	hostname	Combines ping and tracert with packet loss statistics.

Implementation:

1. hostname

```
C:\Users\Nikhil>hostname
DESKTOP-A45M567

C:\Users\Nikhil>
```

9. pathping

Description:

No.	Option	Description
1	pathping google.com	Combines ping and tracert with packet loss statistics.

Implementation:

1. pathping google.com

```
C:\Users\Nikhil>pathping google.com

Tracing route to google.com [2404:6800:4009:82f::200e]
over a maximum of 30 hops:
  0  DESKTOP-A45M567 [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]
  1  2409:40c1:3033:cdc9::b7
  2  2405:200:5210:5:3924:110:3:206
  3  2405:200:5210:5:3925::1
  4   *        *        *
Computing statistics for 75 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                            DESKTOP-A45M567 [2409:40c1:3033:cdc9:b17d:390f:e3df:5fe0]
                                0/ 100 =  0%   |
  1    2ms      0/ 100 =  0%   0/ 100 =  0%    2409:40c1:3033:cdc9::b7
                                7/ 100 =  7%   |
  2  292ms      7/ 100 =  7%   0/ 100 =  0%    2405:200:5210:5:3924:110:3:206
                               93/ 100 = 93%   |
  3  ---      100/ 100 =100%   0/ 100 =  0%    2405:200:5210:5:3925::1

Trace complete.

C:\Users\Nikhil>
```

10. arp
Description:

No.	Option	Description
1	arp -a	Combines ping and tracert with packet loss statistics.
2	arp -d *	Deletes all ARP entries.
3	arp -s <IP> <MAC>	Adds a static entry (requires Admin privileges).

Implementation:

1. arp -a

```
C:\Users\Nikhil>arp -a

Interface: 192.168.189.140 --- 0x7
  Internet Address      Physical Address      Type
  192.168.189.63        de-38-fd-48-0a-a6     dynamic
  192.168.189.133       50-c2-e8-5d-d1-5d     dynamic
  192.168.189.255       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

C:\Users\Nikhil>
```