Tribhuvan University

Institute of Engineering

Pulchowk Campus

A Lab Report on : #2

Basic Networking Commands,

Computer Networks

Submitted By:

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BCT 'B'

Submitted To:

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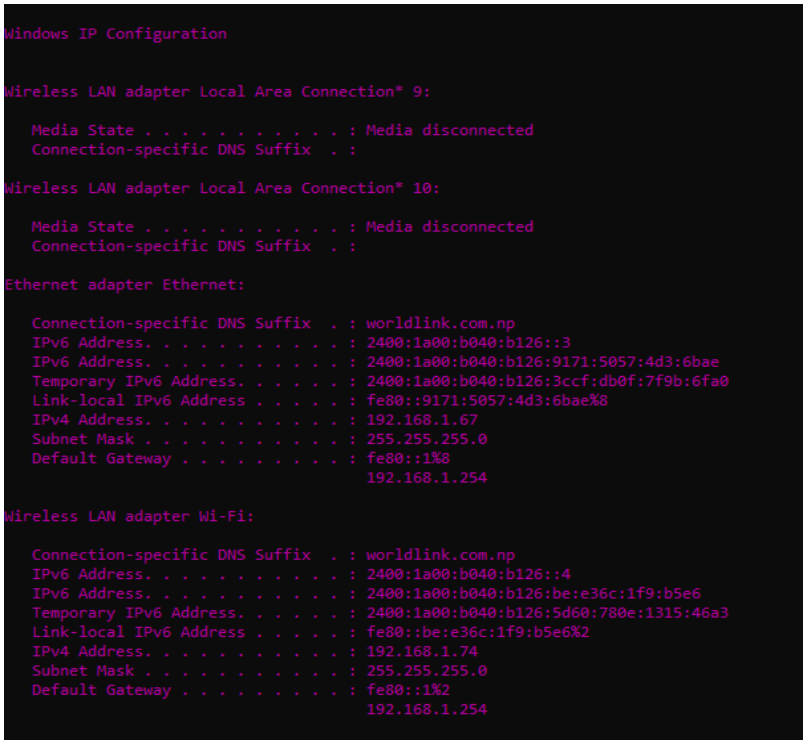
Title:
Basic Networking Commands

Objective:
To be familiar with basic networking commands and their uses

Required Tools:
- A computer with Windows OS
- Internet Connectivity

Procedure:
A computer with windows OS was connected to the internet and following commands were run.
- ipconfig
- getmac
- hostname
- ping
- tracert
- arp
- netstat
- route
- nslookup

Observation:
After each command, following results were observed.
- **ipconfig**



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- **ipconfig/all**

```
Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-99B7Q0Q
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : worldlink.com.np

Wireless LAN adapter Local Area Connection* 9:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : 9E-30-5B-E3-81-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 10:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
   Physical Address. . . . . . . . . : AE-30-5B-E3-81-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . : worldlink.com.np
   Description . . . . . . . . . . . : Realtek PCIe FE Family Controller
   Physical Address. . . . . . . . . : 58-8A-5A-38-A1-B4
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126::3(Preferred)
   Lease Obtained. . . . . . . . . . : 08 June 2022 10:00:51
   Lease Expires . . . . . . . . . . : 08 June 2022 13:00:54
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126:9171:5057:4d3:6bae(Preferred)
   Temporary IPv6 Address. . . . . . : 2400:1a00:b040:b126:3ccf:db0f:7f9b:6fa0(Preferred)
   Link-local IPv6 Address . . . . . : fe80::9171:5057:4d3:6bae%8(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.67(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 08 June 2022 10:00:50
   Lease Expires . . . . . . . . . . : 09 June 2022 10:00:52
   Default Gateway . . . . . . . . . : fe80::1%8
                                       192.168.1.254
   DHCP Server . . . . . . . . . . . : 192.168.1.254
   DHCPv6 IAID . . . . . . . . . . . : 458787418
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-29-D3-37-BC-58-8A-5A-38-A1-B4
   DNS Servers . . . . . . . . . . . : 2400:1a00:0:32::165
                                       2400:1a00:8000:4::73
                                       192.168.1.254
                                       2400:1a00:0:32::165
                                       2400:1a00:8000:4::73
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       worldlink.com.np

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : worldlink.com.np
   Description . . . . . . . . . . . : Qualcomm QCA9377 802.11ac Wireless Adapter
   Physical Address. . . . . . . . . : 9C-30-5B-E3-81-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126::4(Preferred)
   Lease Obtained. . . . . . . . . . : 08 June 2022 12:45:07
   Lease Expires . . . . . . . . . . : 08 June 2022 13:05:07
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126:be:e36c:1f9:b5e6(Preferred)
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126::2(Duplicate)
   Lease Obtained. . . . . . . . . . : 08 June 2022 12:45:05
   Lease Expires . . . . . . . . . . : 08 June 2022 12:48:02
   Temporary IPv6 Address. . . . . . : 2400:1a00:b040:b126:5d60:780e:1315:46a3(Preferred)
   Link-local IPv6 Address . . . . . : fe80::be:e36c:1f9:b5e6%2(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.74(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 07 June 2022 20:08:10
   Lease Expires . . . . . . . . . . : 09 June 2022 12:45:05
   Default Gateway . . . . . . . . . : fe80::1%2
                                       192.168.1.254
   DHCP Server . . . . . . . . . . . : 192.168.1.254
   DHCPv6 IAID . . . . . . . . . . . : 43790427
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-29-D3-37-BC-58-8A-5A-38-A1-B4
   DNS Servers . . . . . . . . . . . : 2400:1a00:0:32::165
                                       2400:1a00:8000:4::73
                                       192.168.1.254
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       worldlink.com.np
```

- **getmac**

```
Physical Address    Transport Name
=================== ============================================================
58-8A-5A-38-A1-B4   \Device\Tcpip_{39445BD6-2B42-4A5A-99CC-B65B541DAA0A}
9C-30-5B-E3-81-E1   \Device\Tcpip_{031EA945-7A5A-49FA-83E4-BEDEB06C05A2}
```

- **hostname**

```
DESKTOP-99B7QOQ
```

- **ping 192.168.1.254** (Default Gateway)

```
Pinging 192.168.1.254 with 32 bytes of data:
Reply from 192.168.1.254: bytes=32 time=1ms TTL=64
Reply from 192.168.1.254: bytes=32 time<1ms TTL=64
Reply from 192.168.1.254: bytes=32 time<1ms TTL=64
Reply from 192.168.1.254: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.254:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

- **ping worldlink.com.np** (ISP)

```
Pinging worldlink.com.np [2400:1a00:0:40:139:570:0:161] with 32 bytes of data:
Reply from 2400:1a00:0:40:139:570:0:161: time=5ms
Reply from 2400:1a00:0:40:139:570:0:161: time=5ms
Reply from 2400:1a00:0:40:139:570:0:161: time=5ms
Reply from 2400:1a00:0:40:139:570:0:161: time=4ms

Ping statistics for 2400:1a00:0:40:139:570:0:161:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 5ms, Average = 4ms
```

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- **ping google.com**

```
Pinging google.com [2404:6800:4009:82f::200e] with 32 bytes of data:
Reply from 2404:6800:4009:82f::200e: time=37ms
Reply from 2404:6800:4009:82f::200e: time=43ms
Reply from 2404:6800:4009:82f::200e: time=38ms
Reply from 2404:6800:4009:82f::200e: time=37ms

Ping statistics for 2404:6800:4009:82f::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 37ms, Maximum = 43ms, Average = 38ms
```

- **ping 103.5.150.3**

```
Pinging 103.5.150.3 with 32 bytes of data:
Reply from 103.5.150.3: bytes=32 time=7ms TTL=58
Reply from 103.5.150.3: bytes=32 time=4ms TTL=58
Reply from 103.5.150.3: bytes=32 time=3ms TTL=58
Reply from 103.5.150.3: bytes=32 time=6ms TTL=58

Ping statistics for 103.5.150.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 7ms, Average = 5ms
```

- **tracert 192.168.1.254** (Default Gateway)

```
Tracing route to 192.168.1.254 over a maximum of 30 hops

  1    <1 ms    <1 ms    <1 ms  192.168.1.254

Trace complete.
```

- **tracert worldlink.com.np** (ISP)

```
Tracing route to worldlink.com.np [2400:1a00:0:40:139:570:0:161]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  2400-1A00-B040.ip6.wlink.com.np [2400:1a00:b040:b126::1]
  2     4 ms     3 ms     5 ms  2400-1A00-B1A4.ip6.wlink.com.np [2400:1a00:b1a4:0:c84d:d2e0:19e3:c608]
  3     5 ms     3 ms     2 ms  2400:1a00:0:1::226
  4     *        6 ms     *     2400:1a00:0:1::154
  5     7 ms     3 ms     5 ms  2400:1a00:0:40:139:570:0:161
```

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- **tracert google.com**

```
Tracing route to google.com [2404:6800:4009:826::200e]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  2400-1A00-B040.ip6.wlink.com.np [2400:1a00:b040:b126::1]
  2     4 ms     6 ms     2 ms  2400-1A00-B1A4.ip6.wlink.com.np [2400:1a00:b1a4:0:c84d:d2e0:100:0]
  3    11 ms    18 ms    11 ms  2400:1a00:0:1::226
  4     3 ms     6 ms     6 ms  2404:d180:1:212::201
  5    35 ms    36 ms    39 ms  ix-ae-21-137.tcore1.mlv-mumbai.ipv6.as6453.net [2001:5a0:2300:200::b9]
  6    41 ms     *        *     2001:5a0:2300:200::b5
  7    37 ms    39 ms    39 ms  2404:6800:8116::1
  8    40 ms    39 ms    39 ms  bom07s33-in-x0e.1e100.net [2404:6800:4009:826::200e]

Trace complete.
```

- **tracert 103.5.150.3**

```
Tracing route to 103.5.150.3 over a maximum of 30 hops

  1    <1 ms    <1 ms    <1 ms  192.168.1.254
  2     4 ms     6 ms     6 ms  27.34.72.1
  3     7 ms     5 ms     4 ms  pppoe-06.wlink.com.np [202.79.40.9]
  4     5 ms     5 ms     4 ms  198-32-231-15.setg.net [198.32.231.15]
  5     6 ms     3 ms     7 ms  snd.core-ptn.core.ntc.net.np [202.70.93.81]
  6     6 ms     6 ms     3 ms  ptn.acc-ptn.core.ntc.net.np [202.70.93.95]
  7     4 ms     7 ms     2 ms  ptn.acc-ptn.ne.acc.ntc.net.np [202.70.93.100]
  8     4 ms     6 ms     7 ms  202.70.79.97
  9     6 ms     4 ms     7 ms  103.5.150.3

Trace complete.
```

- **arp -a**

```
Interface: 192.168.1.67 --- 0x8
  Internet Address      Physical Address      Type
  192.168.1.69          9c-30-5b-e3-81-e1     dynamic
  192.168.1.254         c4-48-fa-8f-02-f0     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
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

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- **ping 192.168.1.64**(another device in network) followed by **arp -a**

```
Pinging 192.168.1.64 with 32 bytes of data:
Reply from 192.168.1.64: bytes=32 time=54ms TTL=64
Reply from 192.168.1.64: bytes=32 time=7ms TTL=64
Reply from 192.168.1.64: bytes=32 time=6ms TTL=64
Reply from 192.168.1.64: bytes=32 time=7ms TTL=64

Ping statistics for 192.168.1.64:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 54ms, Average = 18ms
```

```
Interface: 192.168.1.67 --- 0x8
  Internet Address      Physical Address      Type
  192.168.1.64          62-69-e0-c5-d3-41     dynamic
  192.168.1.69          9c-30-5b-e3-81-e1     dynamic
  192.168.1.254         c4-48-fa-8f-02-f0     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
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

- **netstat**

```
Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    192.168.1.67:51649     20.198.162.78:https    ESTABLISHED
  TCP    192.168.1.67:56607     162.159.136.234:https  ESTABLISHED
  TCP    192.168.1.67:57041     ec2-52-37-252-23:https  CLOSE_WAIT
  TCP    192.168.1.67:57042     20.44.229.112:https    ESTABLISHED
  TCP    192.168.1.67:57044     52.137.103.96:https    ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:56998  2400-1A00-CD11:https   CLOSE_WAIT
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57018  2400-1A00-CD11:https   CLOSE_WAIT
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57030  edge-star6-shv-02-pnq1:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57031  edge-msgr-latest6-shv-02-pnq1:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57036  edge-star6-shv-02-pnq1:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57046  [2600:9000:237c:3400:15:85fe:56c0:93a1]:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:59027  [2600:1901:1:e52::]:https  ESTABLISHED
```

- **netstat -e**

```
Interface Statistics

                           Received            Sent

Bytes                    1315935476        34645096
Unicast packets             1074394          241184
Non-unicast packets            2064            2020
Discards                         56               0
Errors                            0               0
Unknown protocols                 0
```

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- **netstat -r**

```
===========================================================================
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.1.254     192.168.1.67     35
        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
      192.168.1.0    255.255.255.0         On-link      192.168.1.67    291
     192.168.1.67  255.255.255.255         On-link      192.168.1.67    291
    192.168.1.255  255.255.255.255         On-link      192.168.1.67    291
        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      192.168.1.67    291
  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      192.168.1.67    291
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  8   4131 ::/0                     fe80::1
  1    331 ::1/128                  On-link
  8   4131 2400:1a00:b040:9bb8::/64 On-link
  8     51 2400:1a00:b040:9bb8::/64 fe80::1
  8    291 2400:1a00:b040:9bb8::2/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:9171:5057:4d3:6bae/128
                                    On-link
  8    291 fe80::/64                 On-link
  8    291 fe80::9171:5057:4d3:6bae/128
                                    On-link
  1    331 ff00::/8                  On-link
  8    291 ff00::/8                  On-link
===========================================================================
Persistent Routes:
  None
```

- **netstat -s**

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```
IPv4 Statistics

  Packets Received                   = 1460557
  Received Header Errors             = 0
  Received Address Errors            = 0
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 18201
  Received Packets Delivered         = 1464399
  Output Requests                    = 914349
  Routing Discards                   = 0
  Discarded Output Packets           = 128
  Output Packet No Route             = 124
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0

IPv6 Statistics

  Packets Received                   = 1423110
  Received Header Errors             = 0
  Received Address Errors            = 17
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 164
  Received Packets Delivered         = 1423724
  Output Requests                    = 281583
  Routing Discards                   = 0
  Discarded Output Packets           = 0
  Output Packet No Route             = 5
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0
```

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```
ICMPv4 Statistics

                            Received    Sent
  Messages                  74          120
  Errors                    0           0
  Destination Unreachable   43          89
  Time Exceeded             24          0
  Parameter Problems        0           0
  Source Quenches           0           0
  Redirects                 0           0
  Echo Replies              7           0
  Echos                     0           31
  Timestamps                0           0
  Timestamp Replies         0           0
  Address Masks             0           0
  Address Mask Replies      0           0
  Router Solicitations      0           0
  Router Advertisements     0           0

ICMPv6 Statistics

                            Received    Sent
  Messages                  14414       14511
  Errors                    0           0
  Destination Unreachable   0           96
  Packet Too Big            0           0
  Time Exceeded             0           0
  Parameter Problems        0           0
  Echos                     0           0
  Echo Replies              0           0
  MLD Queries               0           0
  MLD Reports               0           0
  MLD Dones                 0           0
  Router Solicitations      0           25
  Router Advertisements     78          0
  Neighbor Solicitations    13768       598
  Neighbor Advertisements   568         13792
  Redirects                 0           0
  Router Renumberings       0           0
```

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```
TCP Statistics for IPv4

  Active Opens                            = 4623
  Passive Opens                           = 2961
  Failed Connection Attempts              = 121
  Reset Connections                       = 319
  Current Connections                     = 3
  Segments Received                       = 1405078
  Segments Sent                           = 848553
  Segments Retransmitted                  = 0

TCP Statistics for IPv6

  Active Opens                            = 736
  Passive Opens                           = 0
  Failed Connection Attempts              = 135
  Reset Connections                       = 122
  Current Connections                     = 7
  Segments Received                       = 158454
  Segments Sent                           = 93708
  Segments Retransmitted                  = 0

UDP Statistics for IPv4

  Datagrams Received    = 132006
  No Ports              = 16362
  Receive Errors        = 1862
  Datagrams Sent        = 71819

UDP Statistics for IPv6

  Datagrams Received    = 1250665
  No Ports              = 164
  Receive Errors        = 0
  Datagrams Sent        = 158672
```

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- **route print**

```
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.1.254     192.168.1.67     35
        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
      192.168.1.0    255.255.255.0         On-link      192.168.1.67    291
     192.168.1.67  255.255.255.255         On-link      192.168.1.67    291
    192.168.1.255  255.255.255.255         On-link      192.168.1.67    291
        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      192.168.1.67    291
  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      192.168.1.67    291
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  8   4131 ::/0                     fe80::1
  1    331 ::1/128                  On-link
  8   4131 2400:1a00:b040:9bb8::/64 On-link
  8     51 2400:1a00:b040:9bb8::/64 fe80::1
  8    291 2400:1a00:b040:9bb8::2/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:9171:5057:4d3:6bae/128
                                    On-link
  8    291 fe80::/64                On-link
  8    291 fe80::9171:5057:4d3:6bae/128
                                    On-link
  1    331 ff00::/8                 On-link
  8    291 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

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- **route print -4**

```
===========================================================================
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.1.254     192.168.1.67     35
        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
      192.168.1.0    255.255.255.0         On-link      192.168.1.67    291
     192.168.1.67  255.255.255.255         On-link      192.168.1.67    291
    192.168.1.255  255.255.255.255         On-link      192.168.1.67    291
        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      192.168.1.67    291
  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      192.168.1.67    291
===========================================================================
Persistent Routes:
  None
```

- **route print -6**

```
===========================================================================
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  8   4131 ::/0                    fe80::1
  1    331 ::1/128                 On-link
  8   4131 2400:1a00:b040:9bb8::/64 On-link
  8     51 2400:1a00:b040:9bb8::/64 fe80::1
  8    291 2400:1a00:b040:9bb8::2/128
                                   On-link
  8    291 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961/128
                                   On-link
  8    291 2400:1a00:b040:9bb8:9171:5057:4d3:6bae/128
                                   On-link
  8    291 fe80::/64               On-link
  8    291 fe80::9171:5057:4d3:6bae/128
                                   On-link
  1    331 ff00::/8                On-link
  8    291 ff00::/8                On-link
===========================================================================
Persistent Routes:
  None
```

Name: Bishal Katuwal
Roll No: 075BCT028

- **nslookup google.com**

```
Server:  UnKnown
Address:  2400:1a00:0:32::165

Non-authoritative answer:
Name:    google.com
Addresses:  2404:6800:4009:831::200e
          142.251.42.78
```

- **nslookup -type=ns google.com**

```
Server:  UnKnown
Address:  2400:1a00:0:32::165

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

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
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
```

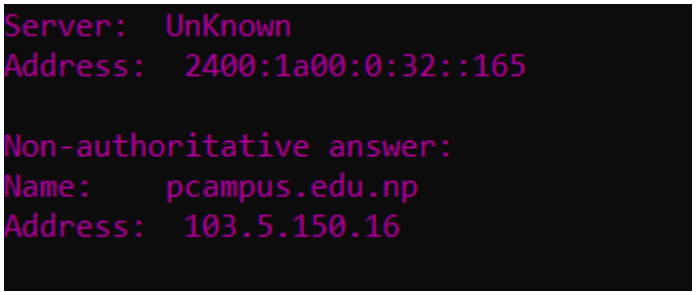
- **nslookup google.com ns1.google.com**

```
Server:  ns1.google.com
Address:  2001:4860:4802:32::a

Name:    google.com
Addresses:  2404:6800:4009:81b::200e
          142.250.76.206
```

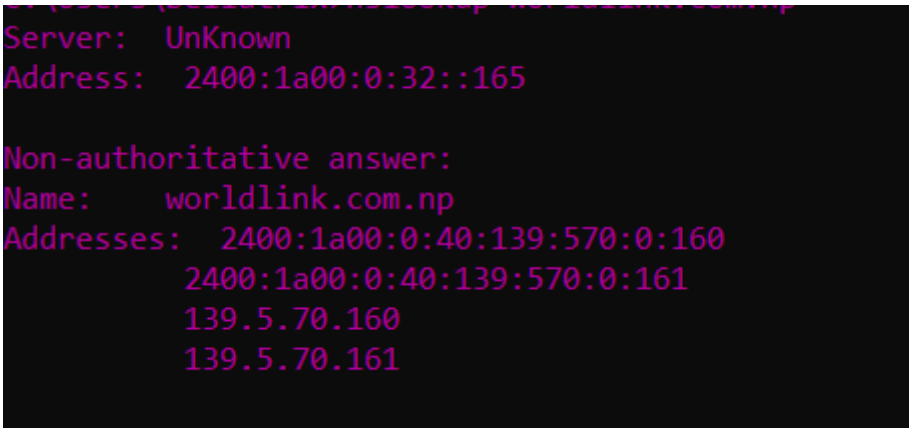
- **nslookup ioe.edu.np**

```
Server:  UnKnown
Address:  2400:1a00:0:32::165

Non-authoritative answer:
Name:    ioe.edu.np
Address:  202.70.67.149
```

- **nslookup pcampus.edu.np**



- **nslookup worldlink.com.np**



Conclusion:

In this way “Lab2:Basic Networking Commands” was completed after studying about different network commands and using them to find their functions.

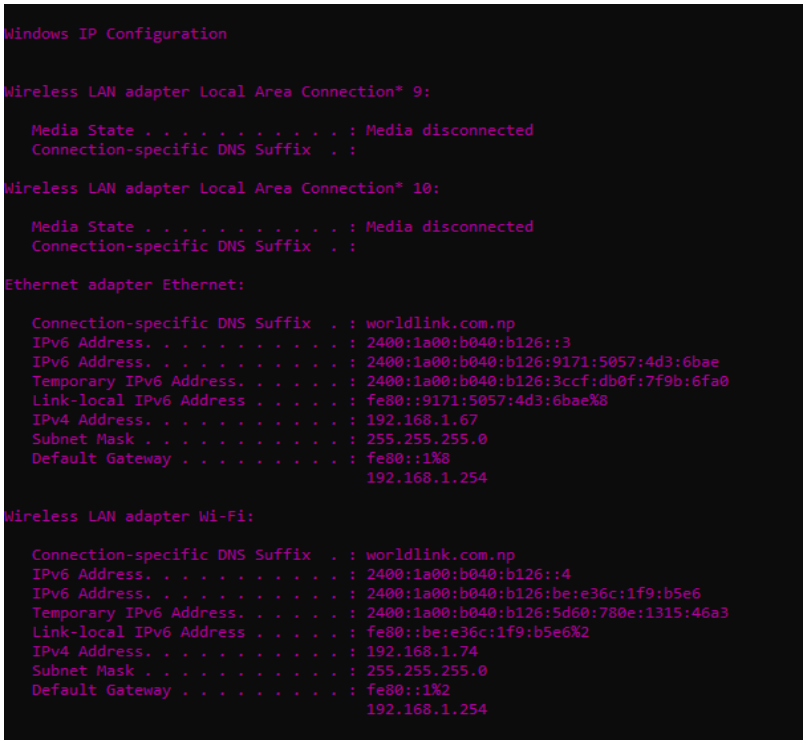
Name: Bishal Katuwal
Roll No: 075BCT028

Exercise:

1. Note down the observation of each step with necessary commands specified in the activities mentioned above and comment on it.

After each command, following results were observed.

- **ipconfig**



The IP configuration of the device for Wi-Fi and Ethernet was obtained.

Name: Bishal Katuwal
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- **ipconfig/all**

```
Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-99B7QOQ
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : worldlink.com.np

Wireless LAN adapter Local Area Connection* 9:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : 9E-30-5B-E3-81-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 10:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
   Physical Address. . . . . . . . . : AE-30-5B-E3-81-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . : worldlink.com.np
   Description . . . . . . . . . . . : Realtek PCIe FE Family Controller
   Physical Address. . . . . . . . . : 58-8A-5A-38-A1-B4
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126::3(Preferred)
   Lease Obtained. . . . . . . . . . : 08 June 2022 10:00:51
   Lease Expires . . . . . . . . . . : 08 June 2022 13:00:54
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126:9171:5057:4d3:6bae(Preferred)
   Temporary IPv6 Address. . . . . . : 2400:1a00:b040:b126:3ccf:db0f:7f9b:6fa0(Preferred)
   Link-local IPv6 Address . . . . . : fe80::9171:5057:4d3:6bae%8(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.67(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 08 June 2022 10:00:50
   Lease Expires . . . . . . . . . . : 09 June 2022 10:00:52
   Default Gateway . . . . . . . . . : fe80::1%8
                                       192.168.1.254
   DHCP Server . . . . . . . . . . . : 192.168.1.254
   DHCPv6 IAID . . . . . . . . . . . : 458787418
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-29-D3-37-BC-58-8A-5A-38-A1-B4
   DNS Servers . . . . . . . . . . . : 2400:1a00:0:32::165
                                       2400:1a00:8000:4::73
                                       192.168.1.254
                                       2400:1a00:0:32::165
                                       2400:1a00:8000:4::73
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       worldlink.com.np

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : worldlink.com.np
   Description . . . . . . . . . . . : Qualcomm QCA9377 802.11ac Wireless Adapter
   Physical Address. . . . . . . . . : 9C-30-5B-E3-81-E1
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126::4(Preferred)
   Lease Obtained. . . . . . . . . . : 08 June 2022 12:45:07
   Lease Expires . . . . . . . . . . : 08 June 2022 13:05:07
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126:be:e36c:1f9:b5e6(Preferred)
   IPv6 Address. . . . . . . . . . . : 2400:1a00:b040:b126::2(Duplicate)
   Lease Obtained. . . . . . . . . . : 08 June 2022 12:45:05
   Lease Expires . . . . . . . . . . : 08 June 2022 12:48:02
   Temporary IPv6 Address. . . . . . : 2400:1a00:b040:b126:5d60:780e:1315:46a3(Preferred)
   Link-local IPv6 Address . . . . . : fe80::be:e36c:1f9:b5e6%2(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.1.74(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 07 June 2022 20:08:10
   Lease Expires . . . . . . . . . . : 09 June 2022 12:45:05
   Default Gateway . . . . . . . . . : fe80::1%2
                                       192.168.1.254
   DHCP Server . . . . . . . . . . . : 192.168.1.254
   DHCPv6 IAID . . . . . . . . . . . : 43790427
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-29-D3-37-BC-58-8A-5A-38-A1-B4
   DNS Servers . . . . . . . . . . . : 2400:1a00:0:32::165
                                       2400:1a00:8000:4::73
                                       192.168.1.254
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       worldlink.com.np
```

The detailed and verbose IP configuration of the device for Wi-Fi and Ethernet was obtained.

- **getmac**

```
Physical Address    Transport Name
=================== ============================================================
58-8A-5A-38-A1-B4   \Device\Tcpip_{39445BD6-2B42-4A5A-99CC-B65B541DAA0A}
9C-30-5B-E3-81-E1   \Device\Tcpip_{031EA945-7A5A-49FA-83E4-BEDEB06C05A2}
```

MAC address of device was obtained

- **hostname**

```
DESKTOP-99B7QOQ
```

Hostname of device was obtained.

- **ping 192.168.1.254** (Default Gateway)

```
Pinging 192.168.1.254 with 32 bytes of data:
Reply from 192.168.1.254: bytes=32 time=1ms TTL=64
Reply from 192.168.1.254: bytes=32 time<1ms TTL=64
Reply from 192.168.1.254: bytes=32 time<1ms TTL=64
Reply from 192.168.1.254: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.254:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Default gateway was pinged. Since there was not much path to cover, there was almost no ping.

- **ping worldlink.com.np** (ISP)

```
Pinging worldlink.com.np [2400:1a00:0:40:139:570:0:161] with 32 bytes of data:
Reply from 2400:1a00:0:40:139:570:0:161: time=5ms
Reply from 2400:1a00:0:40:139:570:0:161: time=5ms
Reply from 2400:1a00:0:40:139:570:0:161: time=5ms
Reply from 2400:1a00:0:40:139:570:0:161: time=4ms

Ping statistics for 2400:1a00:0:40:139:570:0:161:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 5ms, Average = 4ms
```

ISP service provider was pinged. The distance between the device and ISP was very low. Thus there was very low ping.

- **ping google.com**

```
Pinging google.com [2404:6800:4009:82f::200e] with 32 bytes of data:
Reply from 2404:6800:4009:82f::200e: time=37ms
Reply from 2404:6800:4009:82f::200e: time=43ms
Reply from 2404:6800:4009:82f::200e: time=38ms
Reply from 2404:6800:4009:82f::200e: time=37ms

Ping statistics for 2404:6800:4009:82f::200e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 37ms, Maximum = 43ms, Average = 38ms
```

Google was pinged. There was a lot of path to cover between the device and google services, thus relatively high ping was observed.

- **ping 103.5.150.3**

```
Pinging 103.5.150.3 with 32 bytes of data:
Reply from 103.5.150.3: bytes=32 time=7ms TTL=58
Reply from 103.5.150.3: bytes=32 time=4ms TTL=58
Reply from 103.5.150.3: bytes=32 time=3ms TTL=58
Reply from 103.5.150.3: bytes=32 time=6ms TTL=58

Ping statistics for 103.5.150.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 7ms, Average = 5ms
```

103.5.150.3 was pinged. ISP was able to redirect the packets within the country. Thus. Low ping was observed.

- **tracert 192.168.1.254** (Default Gateway)

```
Tracing route to 192.168.1.254 over a maximum of 30 hops

  1    <1 ms    <1 ms    <1 ms  192.168.1.254

Trace complete.
```

Gateway is the first step for any packet. Thus there was no path and also almost no ping.

- **tracert worldlink.com.np** (ISP)

```
Tracing route to worldlink.com.np [2400:1a00:0:40:139:570:0:161]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  2400-1A00-B040.ip6.wlink.com.np [2400:1a00:b040:b126::1]
  2     4 ms     3 ms     5 ms  2400-1A00-B1A4.ip6.wlink.com.np [2400:1a00:b1a4:0:c84d:d2e0:19e3:c608]
  3     5 ms     3 ms     2 ms  2400:1a00:0:1::226
  4     *        6 ms     *     2400:1a00:0:1::154
  5     7 ms     3 ms     5 ms  2400:1a00:0:40:139:570:0:161
```

Connection to ISP had 5 hops with very little delay.

- **tracert google.com**

```
Tracing route to google.com [2404:6800:4009:826::200e]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  2400-1A00-B040.ip6.wlink.com.np [2400:1a00:b040:b126::1]
  2     4 ms     6 ms     2 ms  2400-1A00-B1A4.ip6.wlink.com.np [2400:1a00:b1a4:0:c84d:d2e0:100:0]
  3    11 ms    18 ms    11 ms  2400:1a00:0:1::226
  4     3 ms     6 ms     6 ms  2404:d180:1:212::201
  5    35 ms    36 ms    39 ms  ix-ae-21-137.tcore1.mlv-mumbai.ipv6.as6453.net [2001:5a0:2300:200::b9]
  6    41 ms     *        *     2001:5a0:2300:200::b5
  7    37 ms    39 ms    39 ms  2404:6800:8116::1
  8    40 ms    39 ms    39 ms  bom07s33-in-x0e.1e100.net [2404:6800:4009:826::200e]

Trace complete.
```

When connecting to Google, the packets have to go through 8 hops. While most hops are smaller and have very less ping, international sending and receiving was slow. The UDP packets sent has only short ttl(time to live), * represents ttl exceeded response.

- **tracert 103.5.150.3**

```
Tracing route to 103.5.150.3 over a maximum of 30 hops

  1    <1 ms    <1 ms    <1 ms  192.168.1.254
  2     4 ms     6 ms     6 ms  27.34.72.1
  3     7 ms     5 ms     4 ms  pppoe-06.wlink.com.np [202.79.40.9]
  4     5 ms     5 ms     4 ms  198-32-231-15.setg.net [198.32.231.15]
  5     6 ms     3 ms     7 ms  snd.core-ptn.core.ntc.net.np [202.70.93.81]
  6     6 ms     6 ms     3 ms  ptn.acc-ptn.core.ntc.net.np [202.70.93.95]
  7     4 ms     7 ms     2 ms  ptn.acc-ptn.ne.acc.ntc.net.np [202.70.93.100]
  8     4 ms     6 ms     7 ms  202.70.79.97
  9     6 ms     4 ms     7 ms  103.5.150.3

Trace complete.
```

Connection to 103.5.150.3 had 9 hops with very little delay as all those was within the borders.

- **arp -a**

```
Interface: 192.168.1.67 --- 0x8
  Internet Address      Physical Address      Type
  192.168.1.69          9c-30-5b-e3-81-e1     dynamic
  192.168.1.254         c4-48-fa-8f-02-f0     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
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

The arp(address resolution protocol) shows arp cache. The arp cache is a collection of IP and MAC addresses of devices on local network that the PC knows about.

- **ping 192.168.1.64**(another device in network) followed by **arp -a**

```
Pinging 192.168.1.64 with 32 bytes of data:
Reply from 192.168.1.64: bytes=32 time=54ms TTL=64
Reply from 192.168.1.64: bytes=32 time=7ms TTL=64
Reply from 192.168.1.64: bytes=32 time=6ms TTL=64
Reply from 192.168.1.64: bytes=32 time=7ms TTL=64

Ping statistics for 192.168.1.64:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 54ms, Average = 18ms
```

```
Interface: 192.168.1.67 --- 0x8
  Internet Address      Physical Address      Type
  192.168.1.64          62-69-e0-c5-d3-41     dynamic
  192.168.1.69          9c-30-5b-e3-81-e1     dynamic
  192.168.1.254         c4-48-fa-8f-02-f0     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
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

The IP and MAC of the pinged device was added to arp cache.

- **netstat**

```
Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    192.168.1.67:51649     20.198.162.78:https    ESTABLISHED
  TCP    192.168.1.67:56607     162.159.136.234:https  ESTABLISHED
  TCP    192.168.1.67:57041     ec2-52-37-252-23:https  CLOSE_WAIT
  TCP    192.168.1.67:57042     20.44.229.112:https    ESTABLISHED
  TCP    192.168.1.67:57044     52.137.103.96:https    ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:56998  2400-1A00-CD11:https   CLOSE_WAIT
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57018  2400-1A00-CD11:https   CLOSE_WAIT
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57030  edge-star6-shv-02-pnq1:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57031  edge-msgr-latest6-shv-02-pnq1:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57036  edge-star6-shv-02-pnq1:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:57046  [2600:9000:237c:3400:15:85fe:56c0:93a1]:https  ESTABLISHED
  TCP    [2400:1a00:b040:9bb8:48bc:87d3:ff3e:961]:59027  [2600:1901:1:e52::]:https  ESTABLISHED
```

The netstat command showed a list of all active TCP connections with local IP address(my computer) and foreign IP address (the other network device) with their port numbers, as well as the TCP state.

- **netstat -e**

```
Interface Statistics

                           Received            Sent

Bytes                    1315935476        34645096
Unicast packets             1074394          241184
Non-unicast packets            2064            2020
Discards                         56               0
Errors                            0               0
Unknown protocols                 0
```

This command shows bytes, unicast packets, non-unicast packets, discards, errors, and unknown protocols received and sent since the connection was established.

- **netstat -r**

```
===========================================================================
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.1.254     192.168.1.67     35
        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
      192.168.1.0    255.255.255.0         On-link      192.168.1.67    291
     192.168.1.67  255.255.255.255         On-link      192.168.1.67    291
    192.168.1.255  255.255.255.255         On-link      192.168.1.67    291
        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      192.168.1.67    291
  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      192.168.1.67    291
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  8   4131 ::/0                     fe80::1
  1    331 ::1/128                  On-link
  8   4131 2400:1a00:b040:9bb8::/64 On-link
  8     51 2400:1a00:b040:9bb8::/64 fe80::1
  8    291 2400:1a00:b040:9bb8::2/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:9171:5057:4d3:6bae/128
                                    On-link
  8    291 fe80::/64                On-link
  8    291 fe80::9171:5057:4d3:6bae/128
                                    On-link
  1    331 ff00::/8                 On-link
  8    291 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

This command shows the IP routing table.

- **netstat -s**

```
IPv4 Statistics

  Packets Received                   = 1460557
  Received Header Errors             = 0
  Received Address Errors            = 0
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 18201
  Received Packets Delivered         = 1464399
  Output Requests                    = 914349
  Routing Discards                   = 0
  Discarded Output Packets           = 128
  Output Packet No Route             = 124
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0

IPv6 Statistics

  Packets Received                   = 1423110
  Received Header Errors             = 0
  Received Address Errors            = 17
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 164
  Received Packets Delivered         = 1423724
  Output Requests                    = 281583
  Routing Discards                   = 0
  Discarded Output Packets           = 0
  Output Packet No Route             = 5
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0
```

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Roll No: 075BCT028

```
ICMPv4 Statistics

                            Received    Sent
  Messages                  74          120
  Errors                    0           0
  Destination Unreachable   43          89
  Time Exceeded             24          0
  Parameter Problems        0           0
  Source Quenches           0           0
  Redirects                 0           0
  Echo Replies              7           0
  Echos                     0           31
  Timestamps                0           0
  Timestamp Replies         0           0
  Address Masks             0           0
  Address Mask Replies      0           0
  Router Solicitations      0           0
  Router Advertisements     0           0

ICMPv6 Statistics

                            Received    Sent
  Messages                  14414       14511
  Errors                    0           0
  Destination Unreachable   0           96
  Packet Too Big            0           0
  Time Exceeded             0           0
  Parameter Problems        0           0
  Echos                     0           0
  Echo Replies              0           0
  MLD Queries               0           0
  MLD Reports               0           0
  MLD Dones                 0           0
  Router Solicitations      0           25
  Router Advertisements     78          0
  Neighbor Solicitations    13768       598
  Neighbor Advertisements   568         13792
  Redirects                 0           0
  Router Renumberings       0           0
```

Name: Bishal Katuwal
Roll No: 075BCT028

```
TCP Statistics for IPv4

  Active Opens                            = 4623
  Passive Opens                           = 2961
  Failed Connection Attempts              = 121
  Reset Connections                       = 319
  Current Connections                     = 3
  Segments Received                       = 1405078
  Segments Sent                           = 848553
  Segments Retransmitted                  = 0

TCP Statistics for IPv6

  Active Opens                            = 736
  Passive Opens                           = 0
  Failed Connection Attempts              = 135
  Reset Connections                       = 122
  Current Connections                     = 7
  Segments Received                       = 158454
  Segments Sent                           = 93708
  Segments Retransmitted                  = 0

UDP Statistics for IPv4

  Datagrams Received    = 132006
  No Ports              = 16362
  Receive Errors        = 1862
  Datagrams Sent        = 71819

UDP Statistics for IPv6

  Datagrams Received    = 1250665
  No Ports              = 164
  Receive Errors        = 0
  Datagrams Sent        = 158672
```

The netstat -s command shows detailed statistics by protocol.

- **route print**

```
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.1.254     192.168.1.67     35
        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
      192.168.1.0    255.255.255.0         On-link      192.168.1.67    291
     192.168.1.67  255.255.255.255         On-link      192.168.1.67    291
    192.168.1.255  255.255.255.255         On-link      192.168.1.67    291
        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      192.168.1.67    291
  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      192.168.1.67    291
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  8   4131 ::/0                     fe80::1
  1    331 ::1/128                  On-link
  8   4131 2400:1a00:b040:9bb8::/64 On-link
  8     51 2400:1a00:b040:9bb8::/64 fe80::1
  8    291 2400:1a00:b040:9bb8::2/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961/128
                                    On-link
  8    291 2400:1a00:b040:9bb8:9171:5057:4d3:6bae/128
                                    On-link
  8    291 fe80::/64                On-link
  8    291 fe80::9171:5057:4d3:6bae/128
                                    On-link
  1    331 ff00::/8                 On-link
  8    291 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

This command shows both IPv4 and IPv6 route tables.

- **route print -4**

```
===========================================================================
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.1.254     192.168.1.67     35
        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
      192.168.1.0    255.255.255.0         On-link      192.168.1.67    291
     192.168.1.67  255.255.255.255         On-link      192.168.1.67    291
    192.168.1.255  255.255.255.255         On-link      192.168.1.67    291
        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      192.168.1.67    291
  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      192.168.1.67    291
===========================================================================
Persistent Routes:
  None
```

This command shows only IPv4 route table.

- **route print -6**

```
===========================================================================
Interface List
  5...9e 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter
 15...ae 30 5b e3 81 e1 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  8...58 8a 5a 38 a1 b4 ......Realtek PCIe FE Family Controller
  2...9c 30 5b e3 81 e1 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  8   4131 ::/0                    fe80::1
  1    331 ::1/128                 On-link
  8   4131 2400:1a00:b040:9bb8::/64 On-link
  8     51 2400:1a00:b040:9bb8::/64 fe80::1
  8    291 2400:1a00:b040:9bb8::2/128
                                   On-link
  8    291 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961/128
                                   On-link
  8    291 2400:1a00:b040:9bb8:9171:5057:4d3:6bae/128
                                   On-link
  8    291 fe80::/64               On-link
  8    291 fe80::9171:5057:4d3:6bae/128
                                   On-link
  1    331 ff00::/8                On-link
  8    291 ff00::/8                On-link
===========================================================================
Persistent Routes:
  None
```

This command shows only IPv6 route table.

- **nslookup google.com**

```
Server:  UnKnown
Address:  2400:1a00:0:32::165

Non-authoritative answer:
Name:    google.com
Addresses:  2404:6800:4009:831::200e
          142.251.42.78
```

The nslookup retrieves the requested records that are associated with the domain name provided. Unknown server means that Reverse Lookup Zone isn't created.

- **nslookup -type=ns google.com**

```
Server:  UnKnown
Address:  2400:1a00:0:32::165

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

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
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
```

The nslookup retrieves the requested records that are associated with the domain name provided. Unknown server means that Reverse Lookup Zone isn't created. type=ns views Name Server records.

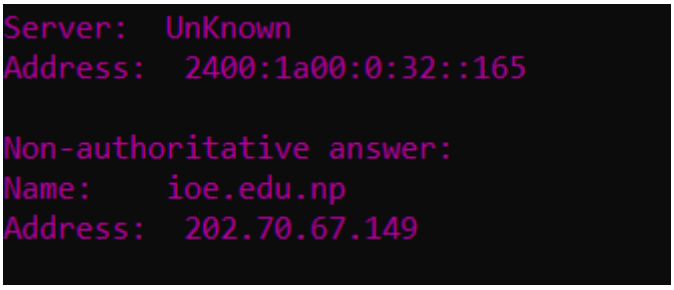
- **nslookup google.com ns1.google.com**

```
Server:  ns1.google.com
Address:  2001:4860:4802:32::a

Name:    google.com
Addresses:  2404:6800:4009:81b::200e
          142.250.76.206
```

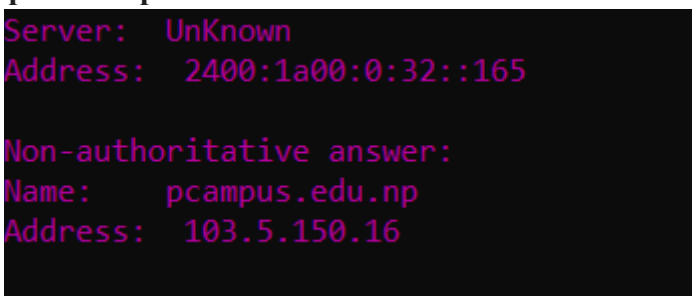
The nslookup retrieves the requested records that are associated with the domain name provided. When nameserver is passed in the command, the result gets limited to the provided nameserver.

- **nslookup ioe.edu.np**



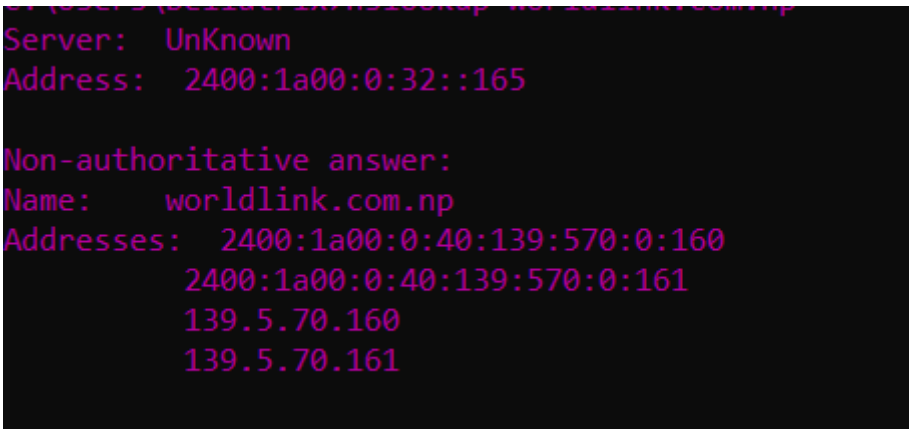
The nslookup retrieves the requested records that are associated with the domain name provided.

- **nslookup pcampus.edu.np**



The nslookup retrieves the requested records that are associated with the domain name provided.

- **nslookup worldlink.com.np**



The nslookup retrieves the requested records that are associated with the domain name provided.

2. What is the IP address & subnet mask of your computer (output of ipconfig)? Also note down the default gateway and DNS of your computer.

IP Address:

IPv6 Address.: 2400:1a00:b040:9bb8:9171:5057:4d3:6bae(Preferred)
Temporary IPv6 Address: 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961(Preferred)
Link-local IPv6 Address: fe80::9171:5057:4d3:6bae%8(Preferred)
IPv4 Address: 192.168.1.67(Preferred)

Subnet Mask

Subnet Mask: 255.255.255.0

Default Gateway
Default Gateway:192.168.1.254
DNS
DNS Servers: 2400:1a00:0:32::165
2400:1a00:8000:4::73
192.168.1.254
2400:1a00:0:32::165
2400:1a00:8000:4::73

3. Now find the Public IP address that is being used for your computer's Internet connectivity (using "what's my ip" in google). Note down both the IP addresses i.e. IP address of your computer obtained using ipconfig and the public IP address that is being used for your computer. Are they the same? Comment on the result.

The public IP addresses found in google are
IPv6: 2400:1a00:b040:9bb8:48bc:87d3:ff3e:961
IPv4: 27.34.68.91

The IP addresses obtained using ipconfig are:
IPv6 Address.: 2400:1a00:b040:9bb8:9171:5057:4d3:6bae
IPv4 Address: 192.168.1.67

The IP address shown on "What's My IP" is the public IP address(aka the external IP address from the connection) whereas ipconfig shows internal IP address. Public IP address is part of a WAN(e.g. The internet) whereas internal IP address is part of LAN. These internal IPs are reserved for LAN by IANA and is not assigned as public or external IPs. External IP addresses are often assigned to a modem or router instead of assigned directly to a computer.

4. Explain the following commands briefly with their functions and most common syntaxes.

a. ipconfig
Ipconfig shows all the TCP/IP configuration values of device and refreshes the DHCP and DNS settings. When used without parameters, ipconfig displays IPv4 and IPv6 addresses, subnet mask, and default gateway for all adapters.

Parameter	**Description**
/all	Displays the full TCP/IP configuration for all adapters.
/displaydns	Displays the content of DNS client resolver cache.
/flushdns	Resets the content of DNS client resolver cache.
/?	Displays help

b. getmac

Getmac returns the MAC address and list of network protocols associated with each address for all network cards in each computer, either locally or across a network.

Parameter	**Description**
/v	Displays verbose information
/?	Displays help

c. ping

Ping command verifies IP connectivity to another TCP/IP device by sending echo request messages. The receipt of corresponding echo reply messages are displayed, along with round-trip times. When used without parameters, this command displays Help content.

Parameter	**Description**
<targetname>	Pings given target
/4	Specifies IPv4 to be used
/6	Specifies IPv6 to be used
/R	Traces round-trip path(IPv6 only)
/?	Displays help

d. tracert

Tracert returns the path taken to a destination by sending echo Request or ICMPv6 messages to the destination with incrementally increasing time to live (TTL) field values.

Parameter	**Description**
<targetname>	Traces given target
/h <NoOfHops>	Specifies maximum number of hops
/4	Specifies IPv4 to be used
/6	Specifies IPv6 to be used
/R	Specifies IPv6 Routing extension header be used
/?	Displays help

e. arp

Arp displays and modifies entries in the Address Resolution Protocol (ARP) cache. The ARP cache contains one or more tables that are used to store IP addresses and their resolved Ethernet or Token Ring physical addresses.

Parameter	Description
/a	Displays current arp cache tables
/g	Same as /a
/d <addr>	Deletes specified entry
/s <inetaddr> <etheraddr>	Adds a static entry to the arp cache that resolves the IP address to the physical address
/?	Displays help

f. netstat

Netstat displays active TCP connections, ports, ethernet statistics, IP routing table, IPv4 statistics and IPv6 statistics. If used without parameters, this command displays active TCP connections.

Parameter	Description
-a	Displays all TCP connections and both TCP and UDP ports
-e	Displays ethernet statistics
-n	Displays active TCP connections
-s	Displays statistics by protocol
-r	Displays IP routing table
/?	Displays help

g. route

Route displays and modifies the entries in the local IP routing table. If used without parameters, route displays help at the command prompt.

Parameter	Description
add	Adds a route.
change	Modifies an existing route.
delete	Deletes a route or routes.
print	Prints a route or routes.
/f	Clears routing table
/?	Displays help

h. nslookup

The nslookup retrieves the requested records that are associated with the domain name provided. It displays information that can be used to diagnose Domain Name System (DNS) infrastructure.

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Parameter	Description
exit	Exits the nslookup command-line tool
finger	Connects with the finger server on the current computer.
help	Displays help
ls	Lists information of DNS domain
lserver	Changes default server to specified DNS domain
root	Changes default server to root of specified DNS domain namespace
server	Changes default server to specified DNS domain
set	Changes configuration settings
view	Sorts and lists the output of the previous ls commands.