Practical 1(A)

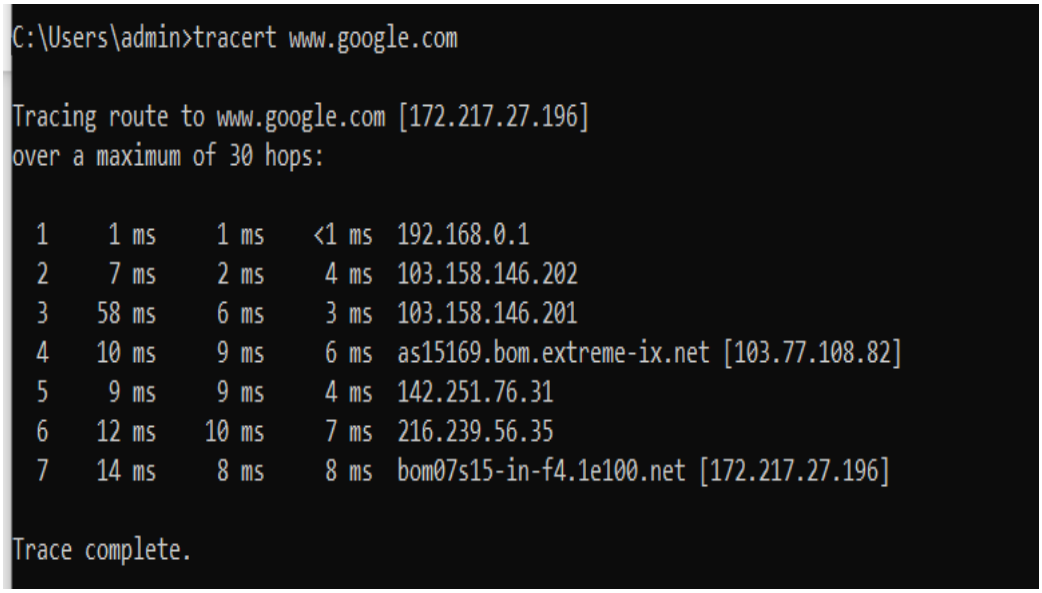
- **Aim: Study of Basic Networking Commands in Computer Networks**

1. **tracert**
    - Purpose: Traces the route taken by packets from the local computer to a specified destination, showing each hop (router) along the way.
    - Values:
        - Helps diagnose network latency and routing issues.
        - Useful for identifying the number of hops and the time taken to reach a destination.
    - Additional Information:
        - Can be crucial for troubleshooting connectivity problems and determining where packets are being dropped.

Example:

```
tracert www.google.com
```

- This command traces the route to Google's website, displaying each hop along with its latency.



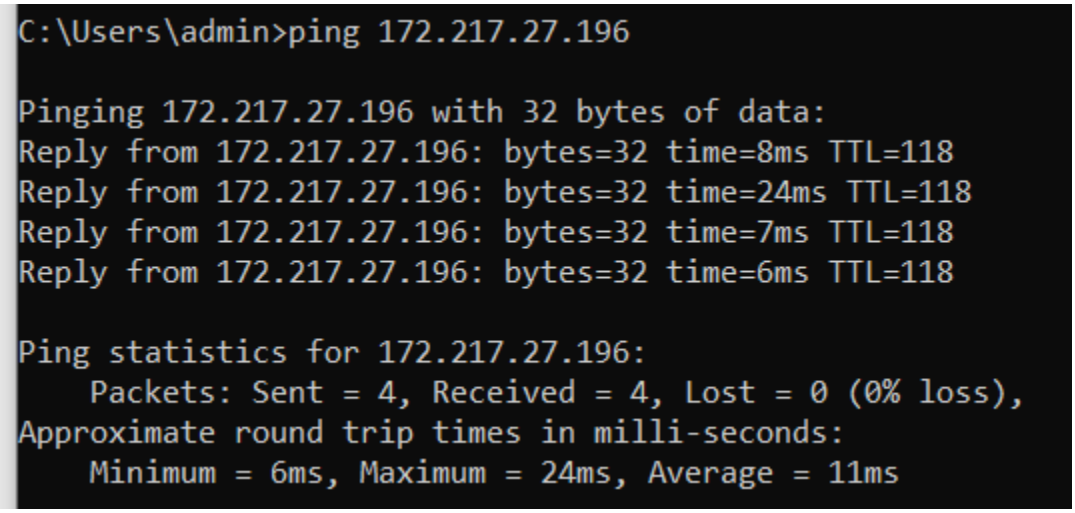
2. **ping**

- Purpose: Tests the reachability of a host on an IP network using ICMP echo requests.
- Values:
  - Quickly verifies if a host is reachable and estimates round-trip time.
  - Essential for basic network troubleshooting and monitoring.
- Additional Information:
  - Can help identify network congestion or packet loss.
  - Provides an indication of network performance and latency.

Example:

```
ping 216.58.208.68
```

- Pings Google's IP address to check connectivity and response time.



3. **ipconfig**
   - Purpose: Displays current TCP/IP network configuration details, manages DHCP settings, and refreshes DNS cache.
   - Values:
     - Shows IP addresses, subnet mask, default gateway, and DNS servers.
     - Useful for diagnosing IP configuration issues and renewing IP leases.
   - Additional Information:
     - `/release` and `/renew` options are helpful for troubleshooting connectivity problems with DHCP.

        - `/flushdns` clears the local DNS resolver cache, resolving DNS-related issues.

Example:
bash

```
ipconfig /all
```

    - Displays detailed configuration information for all interfaces, including DHCP and DNS settings.

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

Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-N2CG9IV
   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. . . . . . . . . : 04-BF-1B-6F-E4-27
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 9:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : 3C-E9-F7-D1-24-F6
   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. . . . . . . . . : 3E-E9-F7-D1-24-F5
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) Wi-Fi 6 AX201 160MHz
   Physical Address. . . . . . . . . : 3C-E9-F7-D1-24-F5
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::8763:54bb:d344:8655%7(Preferred)
```

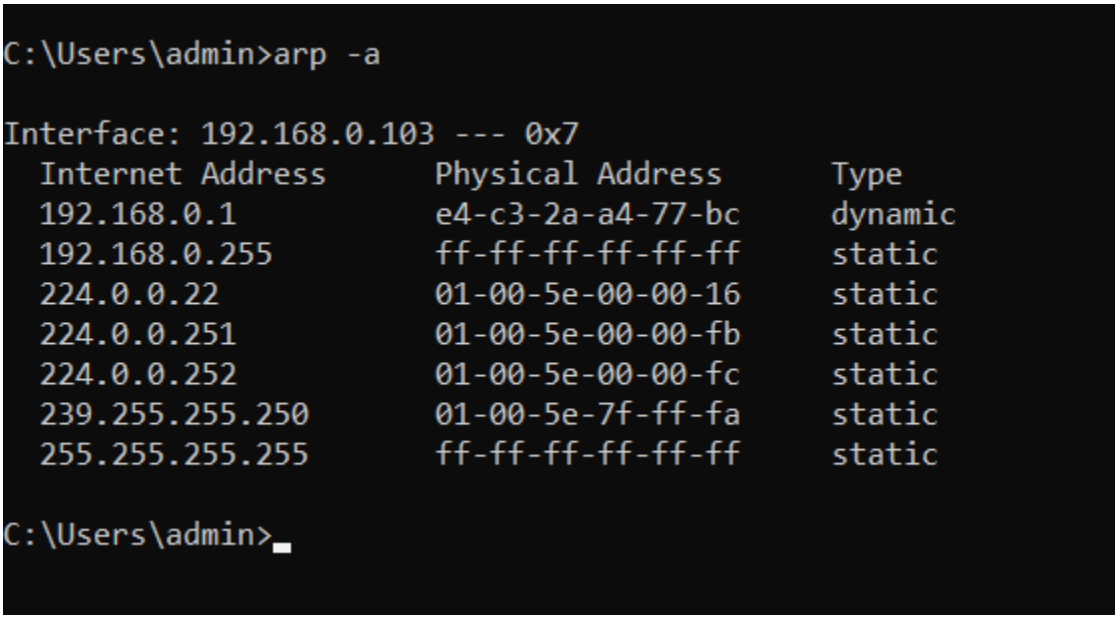
4. **arp**

- Purpose: Displays and modifies the ARP cache, which maps IP addresses to MAC addresses on a local network.
- Values:
  - Resolves IP addresses to physical addresses for data link layer communication.
  - Useful for troubleshooting ARP-related connectivity problems.
- Additional Information:
  - `/a` option shows the current ARP cache entries.
  - Clearing ARP cache (`arp -d`) can resolve connectivity issues in some cases.

Example:

```
arp -a
```

- Displays the ARP cache, listing IP addresses and their corresponding MAC addresses.



5. **netstat**

- Purpose: Displays active TCP connections, listening ports, routing tables, and network statistics.
- Values:
  - Provides information on network connections and interface statistics.
  - Helps monitor network performance and diagnose network issues.
- Additional Information:
  - Useful for identifying open ports and active connections.
  - Various options (`-a`, `-n`, `-b`, etc.) filter and provide specific details.

Example:

```
netstat -an
```

- Shows all active TCP connections with numerical addresses and ports.

```
C:\Users\admin>netstat -an

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            0.0.0.0:0              LISTENING
  TCP    0.0.0.0:445            0.0.0.0:0              LISTENING
  TCP    0.0.0.0:5040           0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49664          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49665          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49668          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49671          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49674          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:49682          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:57621          0.0.0.0:0              LISTENING
  TCP    0.0.0.0:60328          0.0.0.0:0              LISTENING
  TCP    127.0.0.1:6463         0.0.0.0:0              LISTENING
  TCP    127.0.0.1:49708        127.0.0.1:49709        ESTABLISHED
  TCP    127.0.0.1:49709        127.0.0.1:49708        ESTABLISHED
  TCP    127.0.0.1:49710        127.0.0.1:49711        ESTABLISHED
  TCP    127.0.0.1:49711        127.0.0.1:49710        ESTABLISHED
  TCP    127.0.0.1:49712        127.0.0.1:49713        ESTABLISHED
  TCP    127.0.0.1:49713        127.0.0.1:49712        ESTABLISHED
  TCP    127.0.0.1:60217        127.0.0.1:60218        ESTABLISHED
  TCP    127.0.0.1:60218        127.0.0.1:60217        ESTABLISHED
  TCP    192.168.0.103:139      0.0.0.0:0              LISTENING
  TCP    192.168.0.103:60333    104.199.240.237:4070   ESTABLISHED
  TCP    192.168.0.103:60353    35.186.224.40:443      ESTABLISHED
  TCP    192.168.0.103:60354    35.186.224.40:443      ESTABLISHED
  TCP    192.168.0.103:60364    162.159.133.234:443    ESTABLISHED
  TCP    192.168.0.103:60492    104.26.6.95:443        ESTABLISHED
  TCP    192.168.0.103:60494    172.253.118.188:5228   ESTABLISHED
  TCP    192.168.0.103:60522    20.212.88.117:443      ESTABLISHED
  TCP    192.168.0.103:60536    35.190.80.1:443        ESTABLISHED
  TCP    192.168.0.103:60602    172.67.136.130:443     ESTABLISHED
  TCP    192.168.0.103:60635    163.70.143.60:443      ESTABLISHED
  TCP    192.168.0.103:60701    13.107.219.254:443     CLOSE_WAIT
  TCP    192.168.0.103:60708    104.18.5.12:443        TIME_WAIT
  TCP    192.168.0.103:60713    216.58.196.67:443      TIME_WAIT
  TCP    192.168.0.103:60832    23.206.173.83:443      CLOSE_WAIT
  TCP    192.168.0.103:60833    40.99.31.162:443       ESTABLISHED
  TCP    192.168.0.103:60839    13.107.246.254:443     CLOSE_WAIT
  TCP    192.168.0.103:60841    152.199.24.38:443      ESTABLISHED
  TCP    192.168.0.103:60845    35.186.224.22:443      ESTABLISHED
  TCP    192.168.0.103:60846    35.186.224.24:443      TIME_WAIT
```

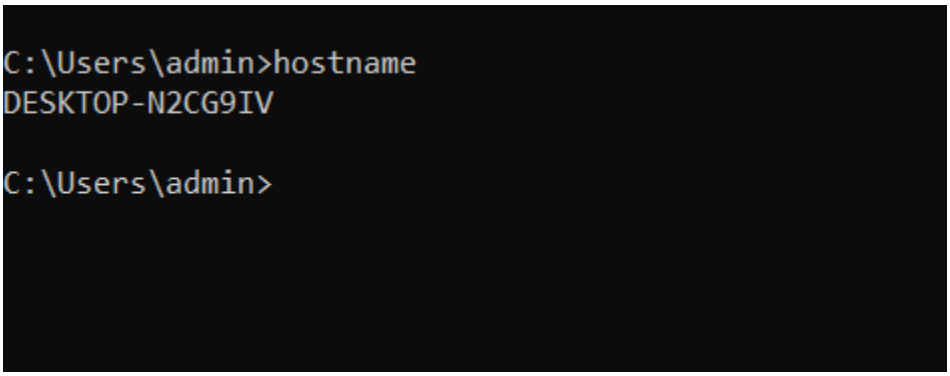
```
  TCP    192.168.0.103:60855    216.58.196.67:443      ESTABLISHED
  TCP    192.168.0.103:60856    52.33.58.172:443       ESTABLISHED
  TCP    192.168.0.103:60857    52.33.58.172:443       ESTABLISHED
  TCP    192.168.0.103:60858    23.48.244.65:443       ESTABLISHED
  TCP    192.168.0.103:60859    52.109.56.129:443      TIME_WAIT
  TCP    192.168.0.103:60860    35.186.224.24:443      ESTABLISHED
  TCP    192.168.0.103:62660    20.198.119.143:443     ESTABLISHED
  TCP    [::]:135               [::]:0                 LISTENING
  TCP    [::]:445               [::]:0                 LISTENING
  TCP    [::]:49664             [::]:0                 LISTENING
  TCP    [::]:49665             [::]:0                 LISTENING
  TCP    [::]:49668             [::]:0                 LISTENING
  TCP    [::]:49671             [::]:0                 LISTENING
  TCP    [::]:49674             [::]:0                 LISTENING
  TCP    [::]:49682             [::]:0                 LISTENING
  TCP    [::1]:49675            [::]:0                 LISTENING
  UDP    0.0.0.0:1900           *:*
  UDP    0.0.0.0:5050           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5355           *:*
  UDP    0.0.0.0:56059          *:*
  UDP    0.0.0.0:57621          *:*
  UDP    0.0.0.0:59094          *:*
  UDP    0.0.0.0:62514          *:*
  UDP    127.0.0.1:1900         *:*
  UDP    127.0.0.1:49664        *:*
  UDP    127.0.0.1:56107        *:*
  UDP    192.168.0.103:137      *:*
  UDP    192.168.0.103:138      *:*
  UDP    192.168.0.103:1900     *:*
  UDP    192.168.0.103:56106    *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5353              *:*
  UDP    [::]:5355              *:*
  UDP    [::1]:1900             *:*
  UDP    [::1]:56105            *:*
  UDP    [fe80::8763:54bb:d344:8655%7]:1900  *:*
  UDP    [fe80::8763:54bb:d344:8655%7]:56104  *:*

C:\Users\admin>
```

6. **hostname**
    - Purpose: Displays the name of the current host (computer).
    - Values:
        - Quickly identifies the computer's hostname, useful in scripting and network configurations.
    - Additional Information:
        - Generally used for basic identification within a local network.

Example:

```
hostname
```

    - Returns the hostname of the local machine.



7. **getmac**
    - Purpose: Displays the Media Access Control (MAC) address(es) of network adapter(s).
    - Values:
        - Identifies unique hardware addresses for network communication.
        - Useful for network troubleshooting and security purposes (MAC filtering).
    - Additional Information:
        - Can display MAC addresses for all network adapters on a system.

Example:

```
getmac
```

- Lists MAC addresses for all network adapters in the system.

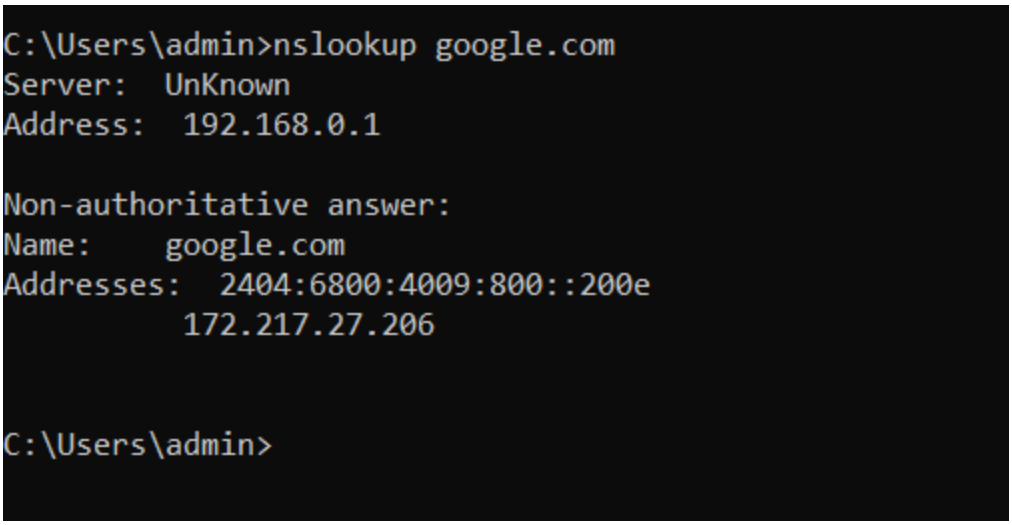
```
C:\Users\admin>getmac

Physical Address    Transport Name
=================== ============================================================
3C-E9-F7-D1-24-F5   \Device\Tcpip_{567EDA07-6B03-4FA8-857D-788B8ED6163E}
04-BF-1B-6F-E4-27   Media disconnected
3C-E9-F7-D1-24-F9   Media disconnected

C:\Users\admin>
```

8. **nslookup**
   - Purpose: Queries DNS servers to retrieve DNS records, including hostname to IP address resolution.
   - Values:
     - Essential for diagnosing DNS-related issues and verifying DNS records.
     - Provides detailed DNS information and can be used for troubleshooting DNS problems.
   - Additional Information:
     - Can perform reverse DNS lookups (`set type=PTR`) to find hostnames for IP addresses.

Example:

```
nslookup google.com
```

   - Performs a DNS lookup for the domain name `google.com`, returning its IP address.



9. **systeminfo**
    - Purpose: Displays comprehensive system configuration information, including OS version, hardware details, and system uptime.
    - Values:
        - Provides detailed insights into the system's hardware and software configuration.
        - Useful for system administration, troubleshooting, and planning upgrades.
    - Additional Information:
        - Can be used to gather information for system audits or technical support.

Example:

```
systeminfo
```

- Outputs detailed system information such as OS version, hardware specs, and installation date.

```
C:\Users\admin>systeminfo

Host Name:                 DESKTOP-N2CG9IV
OS Name:                   Microsoft Windows 10 Pro
OS Version:                10.0.19045 N/A Build 19045
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          admin
Registered Organization:
Product ID:                00330-80000-00000-AA709
Original Install Date:     16-02-2024, 22:01:50
System Boot Time:          13-07-2024, 00:58:33
System Manufacturer:       Dell Inc.
System Model:              Dell G15 5520
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 154 Stepping 3 GenuineIntel ~2500 Mhz
BIOS Version:              Dell Inc. 1.19.1, 29-08-2023
Windows Directory:         C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:               \Device\HarddiskVolume2
System Locale:             en-us;English (United States)
Input Locale:              00004009
Time Zone:                 (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory:     16,069 MB
Available Physical Memory: 8,482 MB
Virtual Memory: Max Size:  18,501 MB
Virtual Memory: Available: 9,185 MB
Virtual Memory: In Use:    9,316 MB
Page File Location(s):     C:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\DESKTOP-N2CG9IV
Hotfix(s):                 11 Hotfix(s) Installed.
                           [01]: KB5039893
                           [02]: KB5034468
                           [03]: KB5011048
                           [04]: KB5015684
                           [05]: KB5040427
                           [06]: KB5034224
                           [07]: KB5036447
                           [08]: KB5037018
                           [09]: KB5037240
                           [10]: KB5037995
                           [11]: KB5039336
Network Card(s):           3 NIC(s) Installed.
                           [01]: Intel(R) Wi-Fi 6 AX201 160MHz
```

10. dig

- Purpose: Queries DNS name servers for DNS records, providing detailed responses from the DNS server.
- Values:

        - Offers more flexibility than `nslookup` in terms of query types and options.
        - Useful for DNS troubleshooting, zone transfers, and querying specific DNS records.
    - Additional Information:
        - Supports various query types (`A`, `MX`, `NS`, `SOA`, etc.) for comprehensive DNS record retrieval.

Example:

```
dig wikipedia.org
```

    - Performs a DNS query for `wikipedia.org`, showing detailed DNS records retrieved from the DNS server.

Each of these commands plays a critical role in network diagnostics, configuration management, and troubleshooting, providing valuable insights and tools for IT professionals and users alike.