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Lab Practical #01:

Study of basic networking commands and IP configuration.

Practical Assignment#01:

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

1. ipconfig

Description:

Displays all current TCP/IP network configuration values and refreshes Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) settings. Used without parameters, ipconfig displays Internet Protocol version 4 (IPv4) and IPv6 addresses, subnet mask, and default gateway for all adapters.

No.	Option	Description
1	/all	Displays the full TCP/IP configuration for all adapters. Adapters can represent physical interfaces, such as installed network adapters, or logical interfaces, such as dial-up connections.
2	/displaydns	Displays the contents of the DNS client resolver cache, which includes both entries preloaded from the local Hosts file and any recently obtained resource records for name queries resolved by the computer. The DNS Client service uses this information to resolve frequently queried names quickly, before querying its configured DNS servers.
3	/flushdns	Flushes and resets the contents of the DNS client resolver cache. During DNS troubleshooting, you can use this procedure to discard negative cache entries from the cache, as well as any other entries that have been added dynamically.

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Implementation:

```
Command Prompt
Microsoft Windows [Version 10.0.22621.1702]
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C:\Users\HP>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

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

Wireless LAN adapter Local Area Connection* 1:

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

Wireless LAN adapter Local Area Connection* 10:

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

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . :
    IPv6 Address. . . . . : 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d
    Temporary IPv6 Address. . . . . : 2402:3a80:16ec:de83:bdb6:7324:507:dc6b
    Link-local IPv6 Address . . . . . : fe80::3480:38c4:8bb9:582a%11
    IPv4 Address. . . . . : 192.168.156.138
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : fe80::c4c9:24ff:fed4:9807%11
```

2. ping

Description:

Verifies IP-level connectivity to another TCP/IP computer by sending Internet Control Message Protocol (ICMP) echo Request messages. The receipt of corresponding echo Reply messages are displayed, along with round-trip times. ping is the primary TCP/IP command used to troubleshoot connectivity, reachability, and name resolution. Used without parameters, this command displays Help content.

You can also use this command to test both the computer name and the IP address of the computer. If pinging the IP address is successful, but pinging the computer name isn't, you might have a name resolution problem. In this case, make sure the computer name you are specifying can be resolved through the local Hosts file, by using Domain Name System (DNS) queries, or through NetBIOS name resolution techniques.

No.	Option	Description
1	/t	Specifies ping continue sending echo Request messages to the destination until interrupted. To interrupt and display statistics, press CTRL+ENTER. To interrupt and quit this command, press CTRL+C.
2	/a	Specifies reverse name resolution be performed on the destination IP address. If this is successful, ping

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		displays the corresponding host name.
3	/f	Specifies that echo Request messages are sent with the Do not Fragment flag in the IP header set to 1 (available on IPv4 only). The echo Request message can't be fragmented by routers in the path to the destination. This parameter is useful for troubleshooting path Maximum Transmission Unit (PMTU) problems.

Implementation:

```
Command Prompt
C:\Users\HP>ping 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d

Pinging 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d with 32 bytes of data:
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time=336ms
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time<1ms
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time<1ms
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time<1ms

Ping statistics for 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 336ms, Average = 84ms

C:\Users\HP>

C:\Users\HP>ping 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d /t

Pinging 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d with 32 bytes of data:
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time<1ms
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time<1ms
Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: time<1ms

Ping statistics for 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d:
    Packets: Sent = 3, Received = 3, Lost = 0 (0% loss),
    Reply from 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d: Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
time<1ms Control-C
^C
C:\Users\HP>ping 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d /f
Ping request could not find host 2402:3a80:16ec:de83:9d8b:7bcd:d9b7:6c6d. Please check the name and try again.
```

3. getmac

Description:

Returns the media access control (MAC) address and list of network protocols associated with each address for all network cards in each computer, either locally or across a network. This command is particularly useful either when you want to enter the MAC address into a network analyzer, or when you need to know what protocols are currently in use on each network adapter on a computer.

No.	Option	Description
1	/s <computer>	Specifies the name or IP address of a remote computer (do not use backslashes). The default is the local computer.
2	/u <domain>\<user>	Runs the command with the account permissions of the user specified by user or domain\user. The

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		default is the permissions of the current logged on user on the computer issuing the command.
3	/v	Specifies that the output display verbose information.

Implementation:

```
Command Prompt
Microsoft Windows [Version 10.0.22621.1702]
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C:\Users\HP>getmac

Physical Address    Transport Name
=====
48-A4-72-09-DD-46   \Device\NPF{67BC4759-1552-475F-BD48-A076566414FB}
84-A9-3E-A9-31-29   Media disconnected

C:\Users\HP>
```

4. Systeminfo

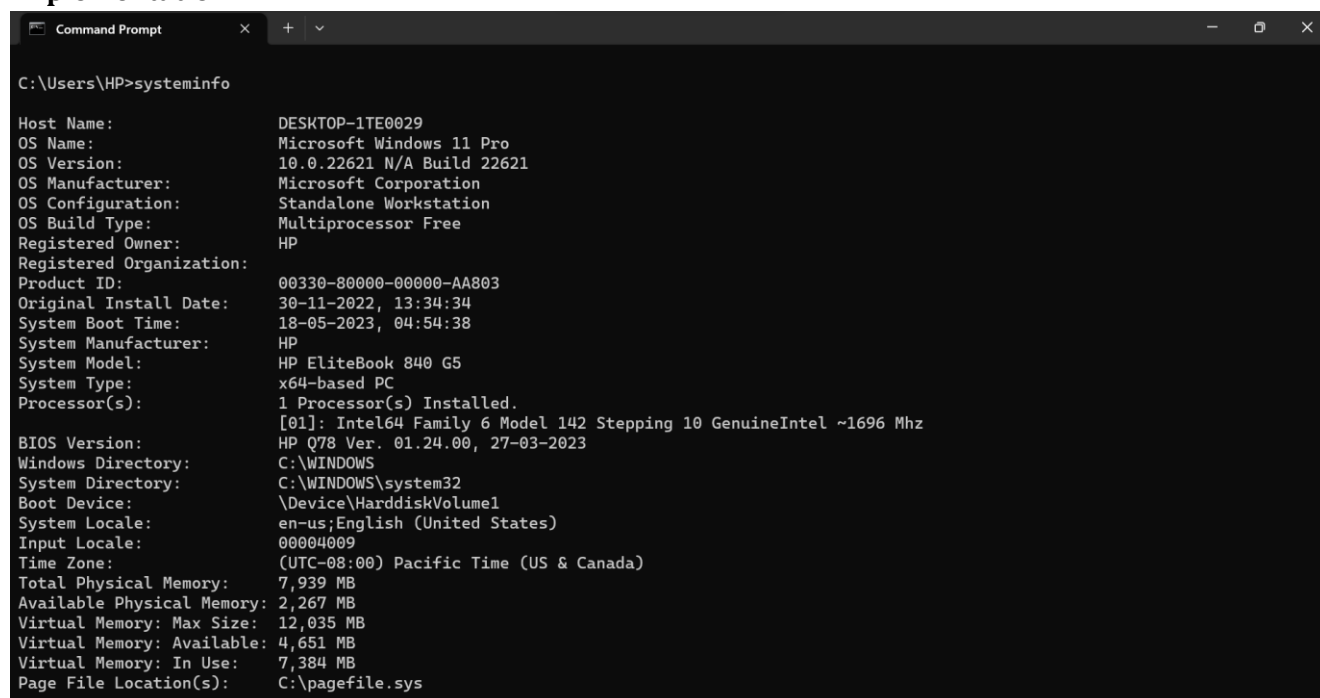
Description:

Displays detailed configuration information about a computer and its operating system, including operating system configuration, security information, product ID, and hardware properties (such as RAM, disk space, and network cards).

No.	Option	Description
1	/s <computer>	Specifies the name or IP address of a remote computer (do not use backslashes). The default is the local computer.
2	/p <password>	Specifies the password of the user account that is specified in the /u parameter.
3	/nh	Suppresses column headers in the output. Valid when the /fo parameter is set to TABLE or CSV.

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Implementation:



```
Command Prompt
C:\Users\HP>systeminfo

Host Name:                DESKTOP-1TE0029
OS Name:                  Microsoft Windows 11 Pro
OS Version:               10.0.22621 N/A Build 22621
OS Manufacturer:         Microsoft Corporation
OS Configuration:        Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:         HP
Registered Organization:
Product ID:                00330-80000-00000-AA803
Original Install Date:     30-11-2022, 13:34:34
System Boot Time:          18-05-2023, 04:54:38
System Manufacturer:      HP
System Model:              HP EliteBook 840 G5
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                          [01]: Intel64 Family 6 Model 142 Stepping 10 GenuineIntel ~1696 Mhz
BIOS Version:              HP Q78 Ver. 01.24.00, 27-03-2023
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-08:00) Pacific Time (US & Canada)
Total Physical Memory:      7,939 MB
Available Physical Memory:  2,267 MB
Virtual Memory: Max Size:  12,035 MB
Virtual Memory: Available: 4,651 MB
Virtual Memory: In Use:     7,384 MB
Page File Location(s):     C:\pagefile.sys
```

5. Traceroute/ tracert.

Description:

This diagnostic tool determines the path taken to a destination by sending Internet Control Message Protocol (ICMP) echo Request or ICMPv6 messages to the destination with incrementally increasing time to live (TTL) field values. Each router along the path is required to decrement the TTL in an IP packet by at least 1 before forwarding it. Effectively, the TTL is a maximum link counter. When the TTL on a packet reaches 0, the router is expected to return an ICMP time Exceeded message to the source computer.

This command determines the path by sending the first echo Request message with a TTL of 1 and incrementing the TTL by 1 on each subsequent transmission until the target responds or the maximum number of hops is reached. The maximum number of hops is 30 by default and can be specified using the /h parameter.

The path is determined by examining the ICMP time Exceeded messages returned by intermediate routers and the echo Reply message returned by the destination. However, some routers do not return time Exceeded messages for packets with expired TTL values and are invisible to the tracert command. In this case, a row of asterisks (*) is displayed for that hop. The path displayed is the list of near/side router interfaces of the routers in the path between a source host and a destination. The near/side interface is the interface of the router that is closest to the sending host in the path.

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No.	Option	Description
1	/d	Stops attempts to resolve the IP addresses of intermediate routers to their names. This can speed up the return of results.
2	/h <maximumhops>	Specifies the maximum number of hops in the path to search for the target (destination). The default is 30 hops.
3	/R	Specifies that the IPv6 Routing extension header be used to send an echo Request message to the local host, using the destination as an intermediate destination and testing the reverse route.

Implementation:

```
Command Prompt
Microsoft Windows [Version 10.0.22621.1702]
(c) Microsoft Corporation. All rights reserved.

C:\Users\HP>tracert google.com

Tracing route to google.com [2404:6800:4009:80e::200e]
over a maximum of 30 hops:

  1  61 ms  3 ms  4 ms  2402:3a80:16ec:de83::75
  2  58 ms  47 ms  33 ms  2402:3a80:16ec:de83:0:1b:d427:540
  3  52 ms  31 ms  40 ms  fd00:abcd:abcd:129::1
  4  62 ms  *  87 ms  fd00:169:254:42::1
  5  45 ms  47 ms  42 ms  2400:5200:1400:7f::2
  6  47 ms  41 ms  43 ms  2402:8100:4000::c13
  7  *  *  *  Request timed out.
  8  86 ms  57 ms  47 ms  2402:6800:760:7::72
  9  63 ms  48 ms  51 ms  2001:4860:1:1::fe8
 10  61 ms  42 ms  45 ms  2404:6800:804b::1
 11  *  *  87 ms  2001:4860:0:1::18b2
 12  81 ms  50 ms  40 ms  2001:4860:0:1::122b
 13  43 ms  44 ms  44 ms  bom07s20-in-x0e.1e100.net [2404:6800:4009:80e::200e]

Trace complete.

C:\Users\HP>
```

6. netstat

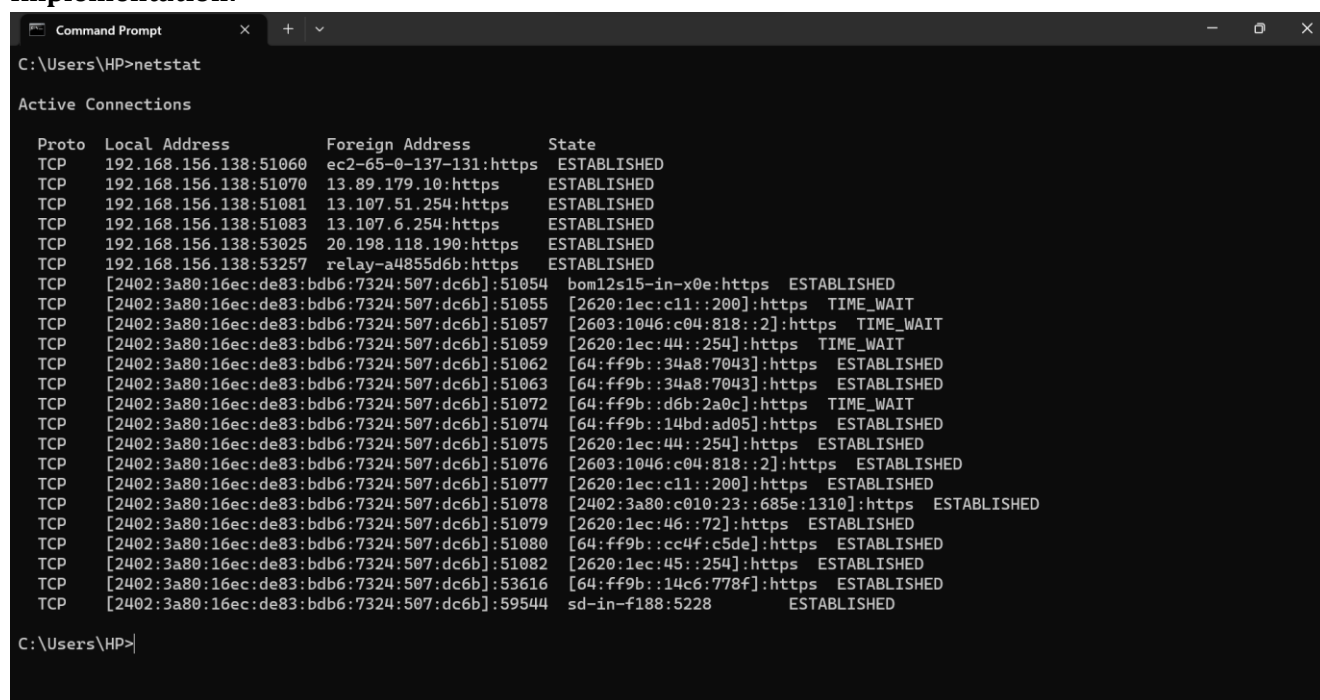
Description:

Displays active TCP connections, ports on which the computer is listening, Ethernet statistics, the IP routing table, IPv4 statistics (for the IP, ICMP, TCP, and UDP protocols), and IPv6 statistics (for the IPv6, ICMPv6, TCP over IPv6, and UDP over IPv6 protocols). Used without parameters, this command displays active TCP connections.

No.	Option	Description
1	-a	Displays all active TCP connections and the TCP and UDP ports on which the computer is listening.

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2	-e	Displays Ethernet statistics, such as the number of bytes and packets sent and received. This parameter can be combined with -s.
3	-n	Displays active TCP connections, however, addresses and port numbers are expressed numerically and no attempt is made to determine names.

Implementation:**7. nslookup****Description:**

Displays information that you can use to diagnose Domain Name System (DNS) infrastructure. Before using this tool, you should be familiar with how DNS works. The nslookup command-line tool is available only if you have installed the TCP/IP protocol.

The nslookup command-line tool has two modes: interactive and noninteractive.

If you need to look up only a single piece of data, we recommend using the non-interactive mode. For the first parameter, type the name or IP address of the computer that you want to look up. For the second parameter, type the name or IP address of a DNS name server. If you omit the second argument, nslookup uses the default DNS name server.

If you need to look up more than one piece of data, you can use interactive mode. Type a hyphen (-) for the first parameter and the name or IP address of a DNS name server for the second parameter. If you omit both parameters, the tool uses the default DNS name server. While using the interactive mode, you can:

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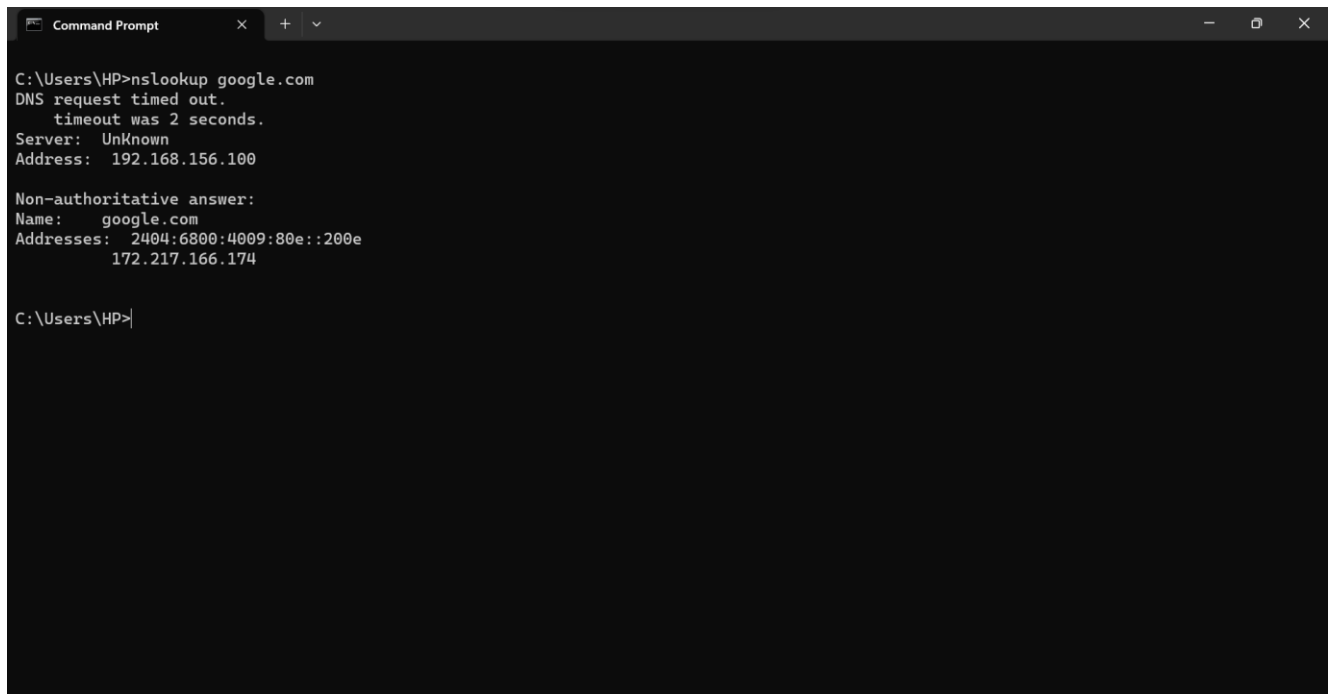
Interrupt interactive commands at any time, by pressing CTRL+B.

Exit, by typing exit.

Treat a built-in command as a computer name, by preceding it with the escape character (\). An unrecognized command is interpreted as a computer name.

No.	Option	Description
1	nslookup root	Changes the default server to the server for the root of the DNS domain name space.
2	nslookup set all	Prints the current values of the configuration settings.
3	nslookup set domain	Changes the default DNS domain name to the name specified.

Implementation:



```
Command Prompt
C:\Users\HP>nslookup google.com
DNS request timed out.
    timeout was 2 seconds.
Server:  Unknown
Address:  192.168.156.100

Non-authoritative answer:
Name:     google.com
Addresses: 2404:6800:4009:80e::200e
          172.217.166.174

C:\Users\HP>
```


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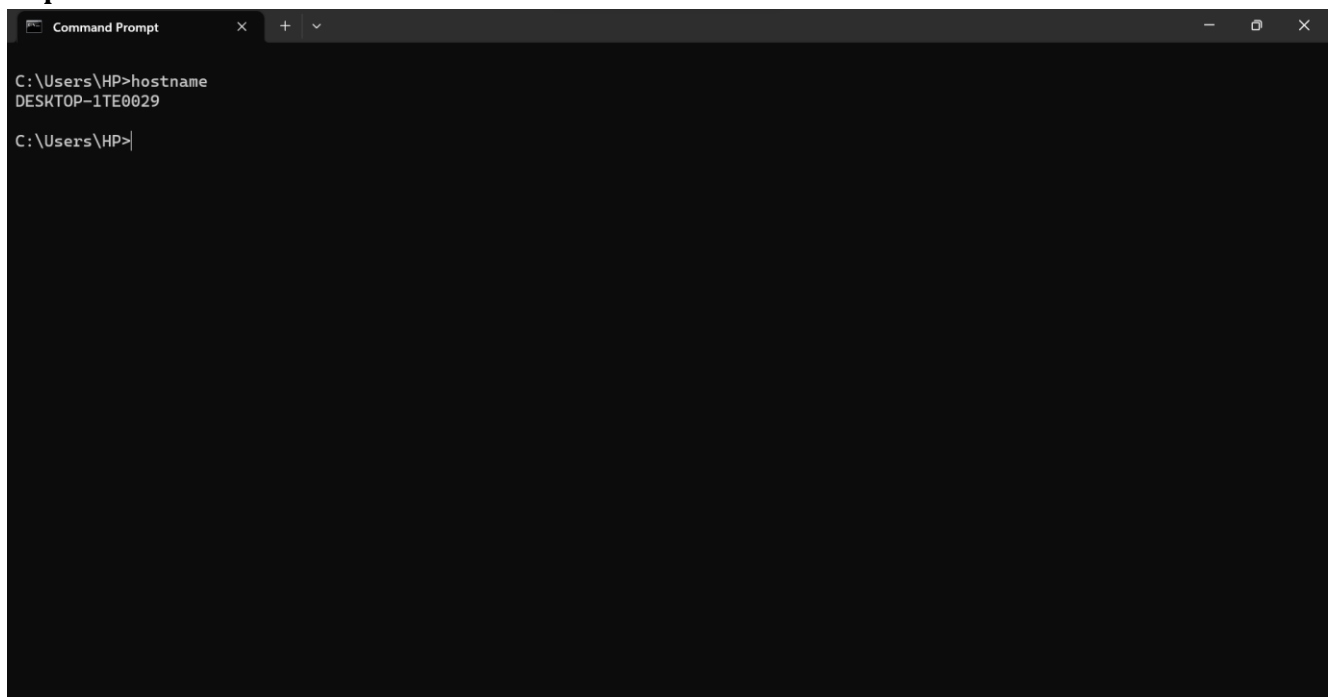
8. hostname

Description:

Displays the host name portion of the full computer name of the computer.

No.	Option	Description
1	/?	Displays help at the command prompt.

Implementation:



```
Command Prompt
C:\Users\HP>hostname
DESKTOP-1TE0029
C:\Users\HP>
```

9. pathping

Description:

Provides information about network latency and network loss at intermediate hops between a source and destination. This command sends multiple echo Request messages to each router between a source and destination, over a period of time, and then computes results based on the packets returned from each router. Because this command displays the degree of packet loss at any given router or link, you can determine which routers or subnets might be having network problems. Used without parameters, this command displays help.

No.	Option	Description
1	/q <numqueries>	Specifies the number of echo Request messages sent to each router in the path. The default is 100 queries.

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2	/i <IPaddress>	Specifies the source address.
3	/w <timeout>	Specifies the number of milliseconds to wait for each reply. The default is 3000 milliseconds (3 seconds). This parameter sends multiple pings in parallel. Because of this, the amount of time specified in the timeout parameter isn't bounded by the amount of time specified in the period parameter for waiting between pings.

Implementation:

```
Command Prompt
C:\Users\HP>pathping google.com

Tracing route to google.com [2404:6800:4009:80e::200e]
over a maximum of 30 hops:
 0  DESKTOP-1TE0029 [2402:3a80:16ec:de83:bdb6:7324:507:dc6b]
 1  2402:3a80:16ec:de83::75
 2  2402:3a80:16ec:de83:0:1b:d427:540
 3  fd00:abcd:abcd:129::1
 4  * * *
Computing statistics for 75 seconds...
Hop  RTT      Source to Here   This Node/Link   Address
     Lost/Sent = Pct  Lost/Sent = Pct
 0           0/ 100 = 0%      0/ 100 = 0%      DESKTOP-1TE0029 [2402:3a80:16ec:de83:bdb6:7324:507:dc6b]
 1    7ms      0/ 100 = 0%      0/ 100 = 0%      2402:3a80:16ec:de83::75
 2    ---     100/ 100 =100%   99/ 100 = 99%    2402:3a80:16ec:de83:0:1b:d427:540
 3   50ms      1/ 100 = 1%      0/ 100 = 0%      fd00:abcd:abcd:129::1
Trace complete.
C:\Users\HP>
```

10.arp**Description:**

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. There is a separate table for each Ethernet or Token Ring network adapter installed on your computer. Used without parameters, arp displays help information.

No.	Option	Description
1	/a [<inetaddr>] /n [<ifaceaddr>]	Displays current arp cache tables for all interfaces. The /n parameter is case-sensitive. To display the arp cache entry for a specific IP address, use arp /a with the inetaddr parameter, where inetaddr is an IP address. If inetaddr is not specified, the first applicable interface is used. To display the arp

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		cache table for a specific interface, use the /n ifaceaddr parameter in conjunction with the /a parameter where inetaddr is the IP address assigned to the interface.
2	<code>[/s <inetaddr> <etheraddr> [<ifaceaddr>]</code>	Adds a static entry to the arp cache that resolves the IP address inetaddr to the physical address etheraddr. To add a static arp cache entry to the table for a specific interface, use the ifaceaddr parameter where ifaceaddr is an IP address assigned to the interface.
3	<code>[/d <inetaddr> [<ifaceaddr>]</code>	Deletes an entry with a specific IP address, where inetaddr is the IP address. To delete an entry in a table for a specific interface, use the ifaceaddr parameter where ifaceaddr is the IP address assigned to the interface. To delete all entries, use the asterisk (*) wildcard character in place of inetaddr.

Implementation:

```
Command Prompt
Microsoft Windows [Version 10.0.22621.1702]
(c) Microsoft Corporation. All rights reserved.

C:\Users\HP>arp -a

Interface: 192.168.156.138 --- 0xb
Internet Address      Physical Address      Type
192.168.156.100       c6-c9-24-d4-98-07     dynamic
192.168.156.255       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
239.255.102.18        01-00-5e-7f-66-12     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\HP>arp -n

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

ARP -s inet_addr eth_addr [if_addr]
ARP -d inet_addr [if_addr]
ARP -a [inet_addr] [-N if_addr] [-v]

-a          Displays current ARP entries by interrogating the current
            protocol data. If inet_addr is specified, the IP and Physical
            addresses for only the specified computer are displayed. If
            more than one network interface uses ARP, entries for each ARP
            table are displayed.
-g          Same as -a.
-v          Displays current ARP entries in verbose mode. All invalid
```