Choosing the pcap file:

V: 23110363
N: 23110224

(363+224) % 10 = 7

Task 1

The following table has been extracted after updating the DNS query packets with the custom headers and then sending them to the server for DNS resolution.

This table contains the query name, the Custom header value and its resolved IP address.

The predefined DNS rules helped map the time to the resolved IP address.

1	Custom header value (HHMMSSID)	Domain name	Resolved IP address
2	01003700	wikipedia.org.	192.168.1.11
3	01003701	reddit.com.	192.168.1.12
4	01003702	apple.com.	192.168.1.13
5	01003703	twitter.com.	192.168.1.14
6	01003704	yahoo.com.	192.168.1.15
7	01003705	linkedin.com.	192.168.1.11

Task 2

In this task, we understood how the traceroute utility works in different operating systems, in our case, Windows and Linux.
‘tracert’ on Windows and ‘traceroute’ on Linux are network diagnostic tools. They show the path a packet takes when transmitted from your computer to a host.

Running ‘tracert’ on Windows Command Prompt

tracert www.google.com

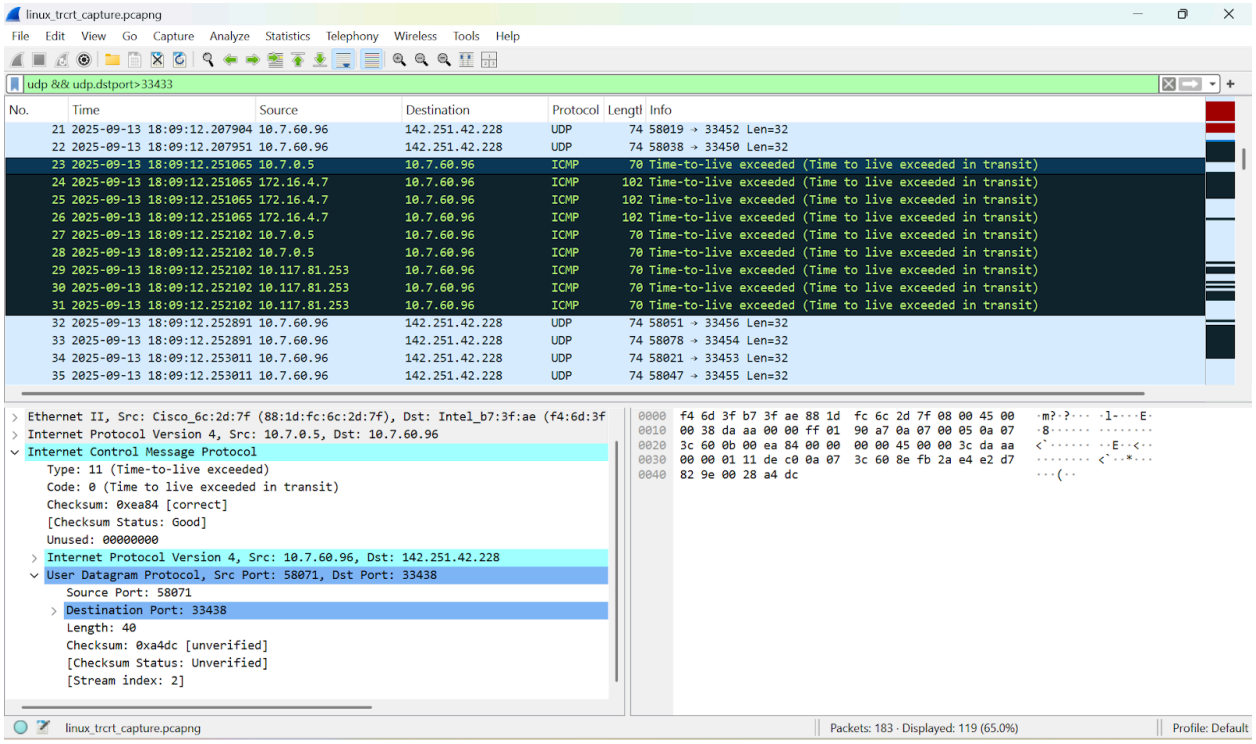
```
C:\Users\nupoo>tracert www.google.com

Tracing route to www.google.com [142.251.42.68]
over a maximum of 30 hops:

  1    28 ms     2 ms     1 ms  10.7.0.5
  2    19 ms     3 ms     3 ms  172.16.4.7
  3     7 ms     3 ms     5 ms  14.139.98.1
  4     6 ms     2 ms     2 ms  10.117.81.253
  5    28 ms    59 ms    10 ms  10.154.8.137
  6    12 ms    22 ms    14 ms  10.255.239.170
  7    12 ms    10 ms     9 ms  10.152.7.214
  8    17 ms    18 ms    13 ms  72.14.204.62
  9    22 ms    15 ms    12 ms  72.14.239.103
 10    13 ms    13 ms    13 ms  142.251.69.105
 11    29 ms    68 ms    67 ms  bom12s21-in-f4.1e100.net [142.251.42.68]

Trace complete.
```

Running ‘traceroute’ on Linux Shell

Traceroute isn’t installed by default
sudo apt install traceroute
traceroute www.google.com

```
nupoor_ka@NKAssudani:~$ traceroute www.google.com
traceroute to www.google.com (142.250.71.100), 30 hops max, 60 byte packets
 1  NKAssudani.mshome.net (172.18.96.1)  1.203 ms  1.169 ms  1.148 ms
 2  10.7.0.5 (10.7.0.5)  3.596 ms  3.575 ms  3.891 ms
 3  172.16.4.7 (172.16.4.7)  3.640 ms  3.616 ms  3.590 ms
 4  14.139.98.1 (14.139.98.1)  5.839 ms  5.133 ms  5.799 ms
 5  10.117.81.253 (10.117.81.253)  3.708 ms  3.689 ms  3.669 ms
 6  10.154.8.137 (10.154.8.137)  13.974 ms  15.279 ms  14.346 ms
 7  10.255.239.170 (10.255.239.170)  15.305 ms  23.557 ms  23.530 ms
 8  10.152.7.214 (10.152.7.214)  23.412 ms  23.402 ms  22.055 ms
 9  72.14.204.62 (72.14.204.62)  23.488 ms  23.478 ms *
10  * * *
11  192.178.86.244 (192.178.86.244)  24.019 ms 142.250.238.196 (142.250.238.196)  13.900 ms 216.239.58.18 (216.239.58.18)  1
5.216 ms
12  192.178.110.208 (192.178.110.208)  17.397 ms 192.178.86.247 (192.178.86.247)  14.850 ms 192.178.110.208 (192.178.110.208
)  12.973 ms
13  192.178.110.249 (192.178.110.249)  14.059 ms 142.250.226.135 (142.250.226.135)  13.363 ms pnbomb-ad-in-f4.1e100.net (142
.250.71.100)  21.921 ms
```

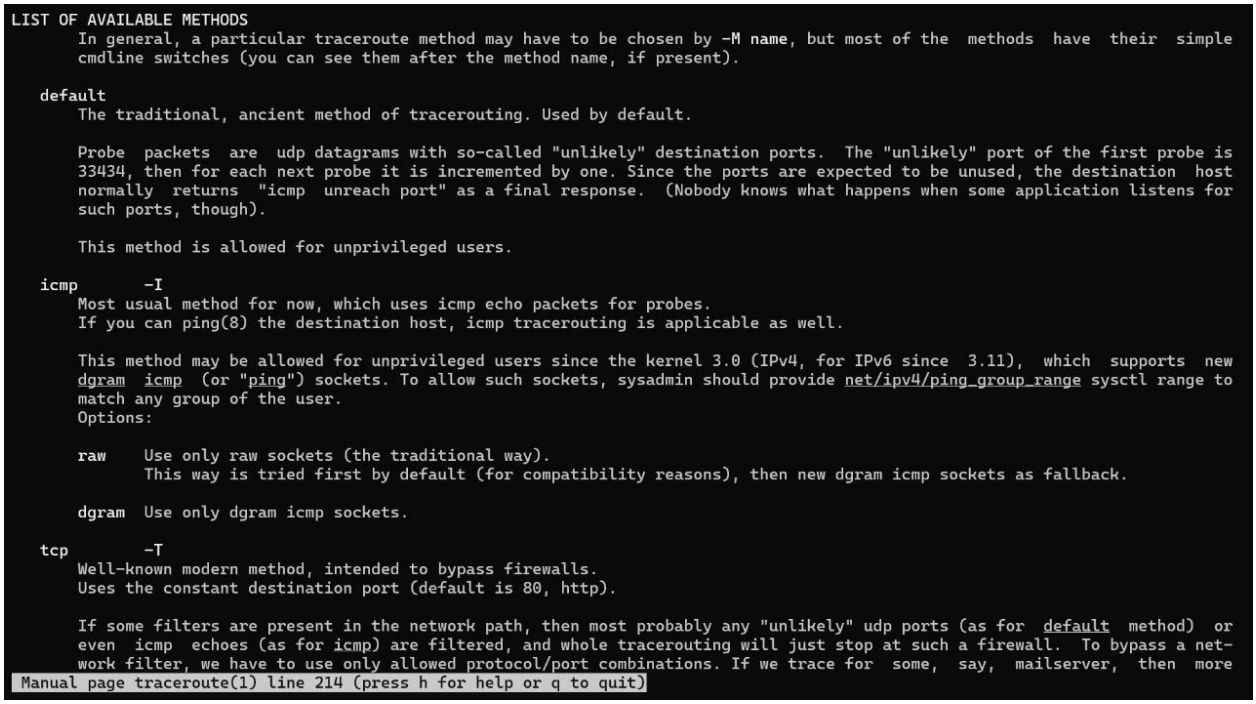
Network Traffic



Questions

Question 1

In Linux, traceroute uses the TTL (time to live) field in the IP header to send UDP requests to routers in the path to the domain servers to get their IP addresses through ICMP messages.



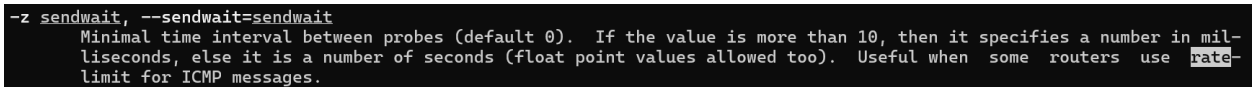
The default section of the above screenshot shows that the Linux traceroute uses ICMP.

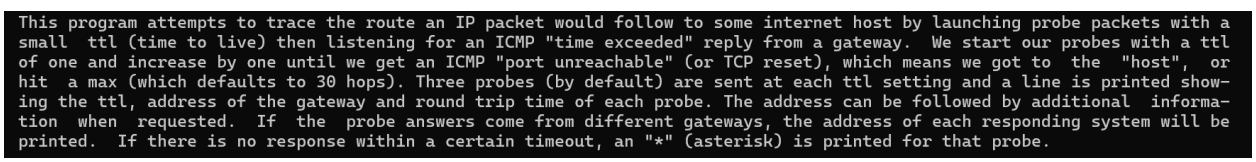
In Windows, tracert uses the ICMP echo protocol, sending ICMP Echo Requests with some times in the TTL field in the IP header to trace the routers in the path between the current device and the server of the domain being looked for.

Question 2

The entry at hop 10 shows '* * *' indicating the router did not reply.
The reasons for this could include that

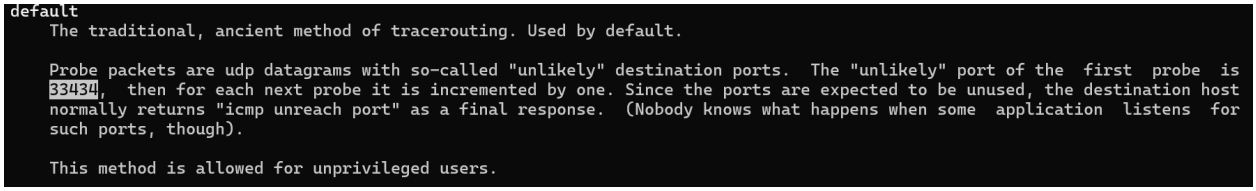
1. the last router reached at that hop had a firewall or security setup that prevents it from being seen or mapped
2. ICMP messages were dropped at that router due to the rate limit.





Question 3

The UDP source port, usually starting from 33434, is incremented by 1 with every change in the probe packet.



Question 4

In the case of tracert in Windows, an ICMP Time Exceeded message is received if the TTL has become zero and the destination hasn't been reached. When a probe reaches the destination, and the probe here is an ICMP Echo Request, our device receives an ICMP Echo Reply, and stops probing, having found the steps to the destination.

In the case of traceroute, used in Linux, intermediate hops receive ICMP Time Exceeded messages, whereas the final hop, one that has reached the destination with TTL>0, receives an ICMP Port Unreachable message, as traceroute uses UDP packets with high, almost certainly unused destination ports as probes.

Question 5

If a firewall blocks UDP but allows ICMP, Windows tracert would work but Linux traceroute wouldn't.
This is because Windows uses ICMP Echo, which is allowed by the firewall, while Linux uses UDP, which has been blocked, so the traceroute would fail, leading to [***] for each hop.

The above screenshots show that the traceroute has the default set as UDP.