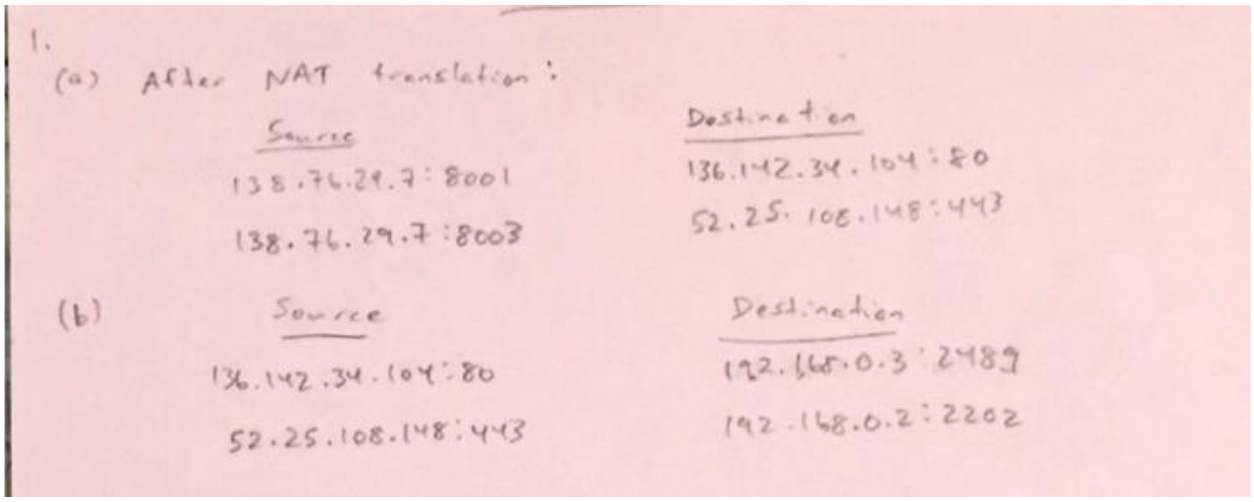
1.



1.

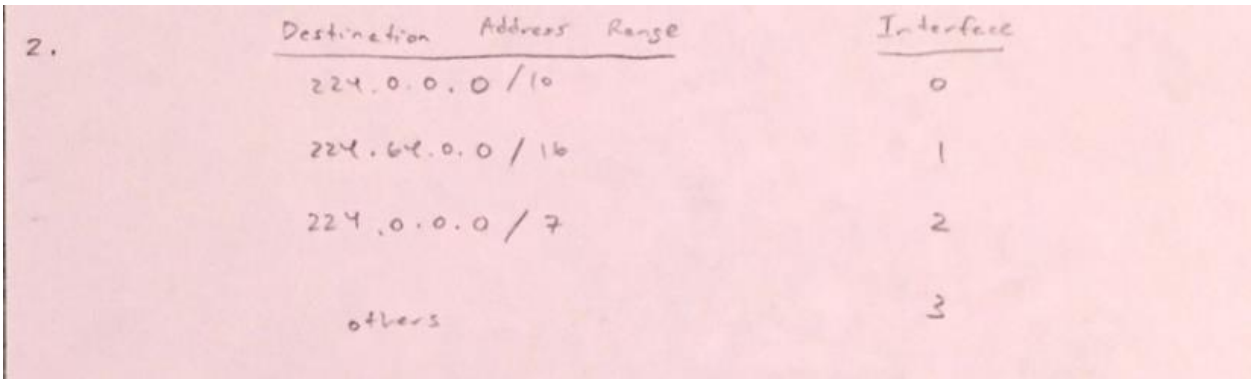
(a) After NAT translation:

| Source | Destination |
|---|---|
| 138.76.29.7:8001 | 136.142.34.104:80 |
| 138.76.29.7:8003 | 52.25.108.148:443 |

(b)

| Source | Destination |
|---|---|
| 136.142.34.104:80 | 192.168.0.3:2489 |
| 52.25.108.148:443 | 192.168.0.2:2202 |

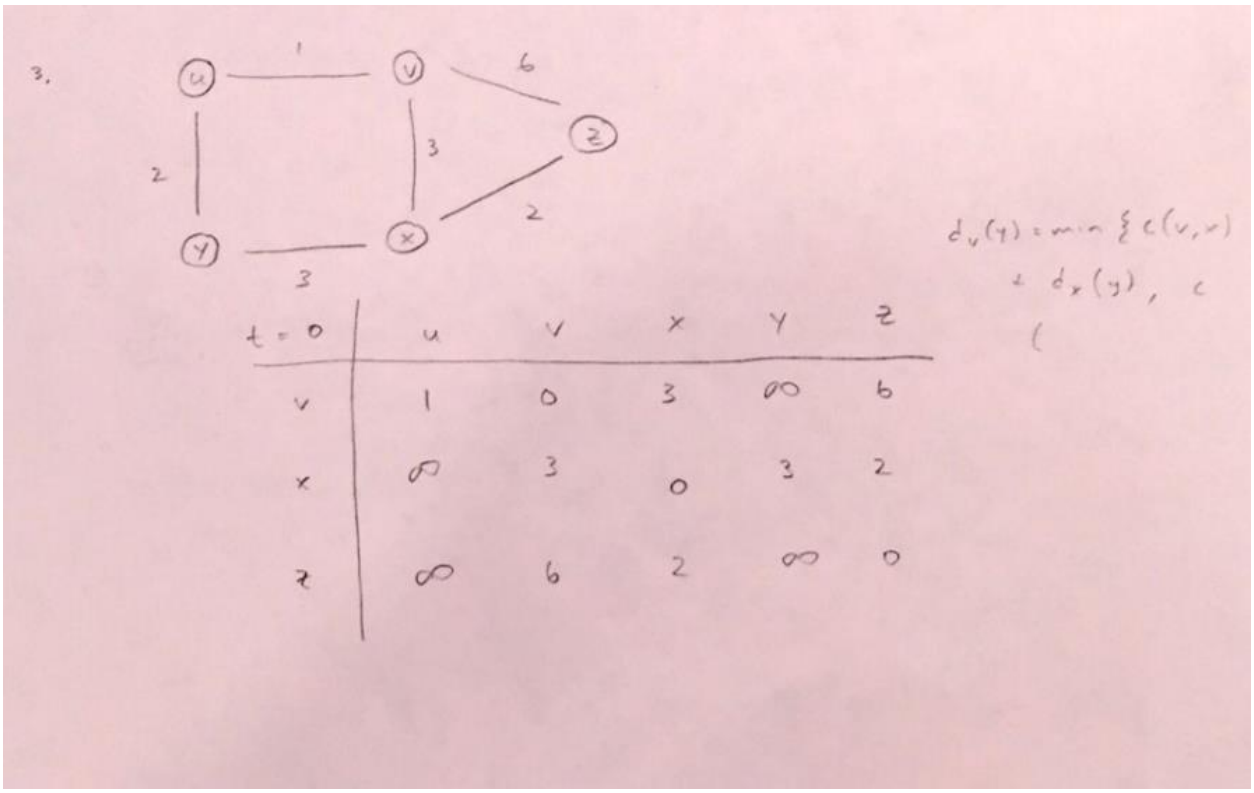
2.



2.

| Destination Address Range | Interface |
|---|---|
| 224.0.0.0/10 | 0 |
| 224.64.0.0/16 | 1 |
| 224.0.0.0/7 | 2 |
| others | 3 |

3.




| t = 0 | u | v | x | y | z |
|---|---|---|---|---|---|
| v | 1 | 0 | 3 | ∞ | 6 |
| x | ∞ | 3 | 0 | 3 | 2 |
| z | ∞ | 6 | 2 | ∞ | 0 |

| t = 1 | u | v | x | y | z |
|---|---|---|---|---|---|
| v | 1 | 0 | 3 | 3 | 5 |
| x | 4 | 3 | 0 | 3 | 2 |
| z | 7 | 5 | 2 | 5 | 0 |

| t = 2 | u | v | x | y | z |
|---|---|---|---|---|---|
| v | 1 | 0 | 3 | 3 | 5 |
| x | 4 | 3 | 0 | 3 | 2 |
| z | 6 | 5 | 2 | 5 | 0 |

4.

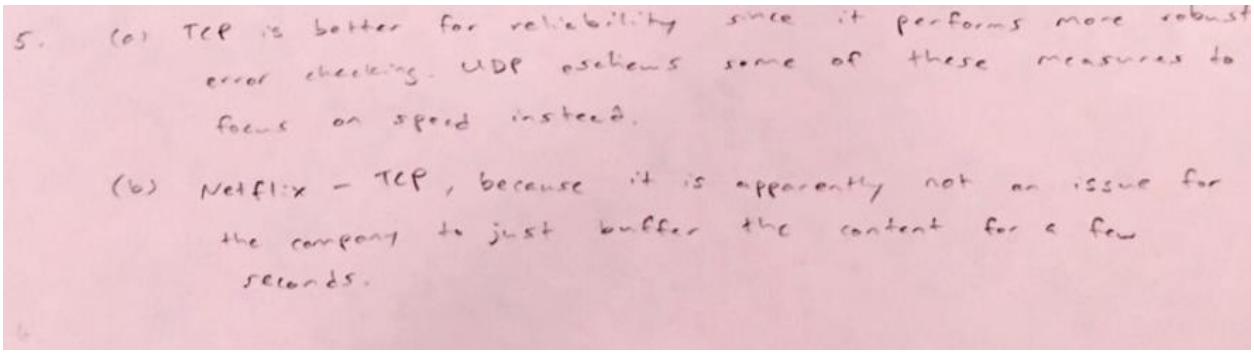
4. (a) The arp -a command shows the mapping of IP addresses to MAC addresses in the same LAN

(b) Destination column is broadcast

(c) ARP response message is broadcast

(d) These ARP messages figure out which device in my LAN the packets are being sent to, either the router or my computer.

5.


5. (a) TCP is better for reliability since it performs more robust error checking. UDP eschews some of these measures to focus on speed instead.

(b) Netflix - TCP, because it is apparently not an issue for the company to just buffer the content for a few seconds.

6.

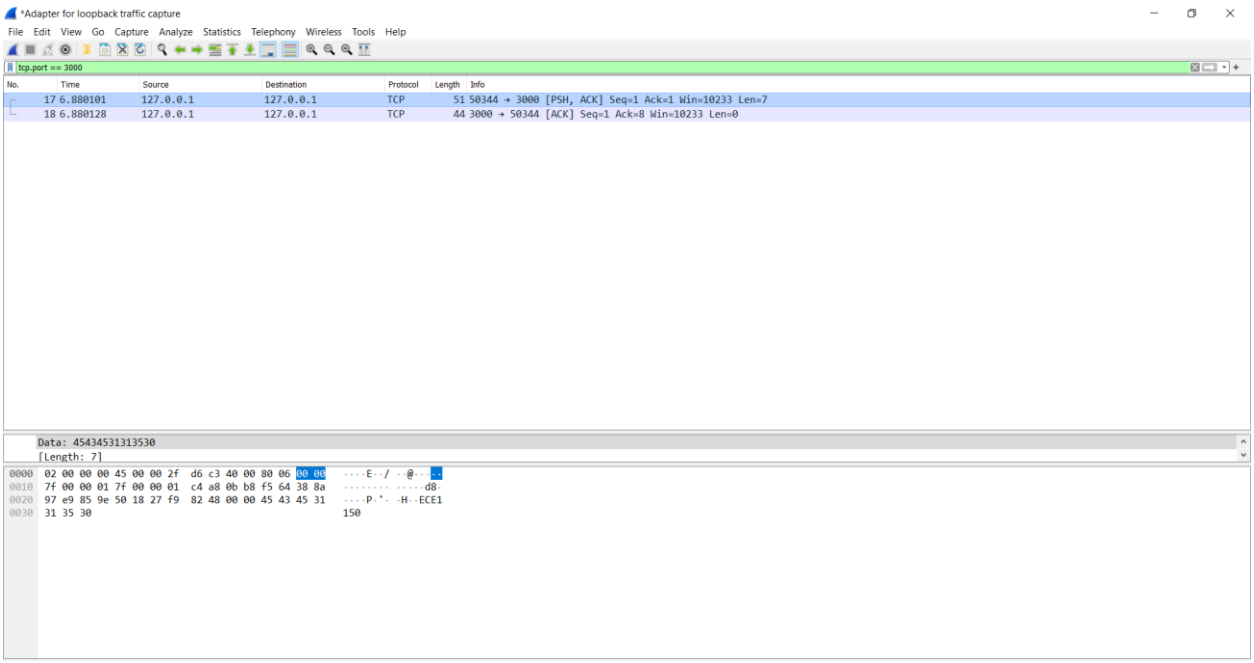
(a)

```
>> c = tcpip("localhost", 3000, 'NetworkRole', 'client')

   TCPIP Object : TCPIP-localhost

   Communication Settings
      RemotePort:         3000
      RemoteHost:         localhost
      Terminator:         'LF'
      NetworkRole:        client

   Communication State
      Status:             closed
      RecordStatus:       off

   Read/Write State
      TransferStatus:     idle
      BytesAvailable:     0
      ValuesReceived:     0
      ValuesSent:         0


>> fopen(c)
>> fwrite(c, "ECE1150")
>> fclose(c)
>>
```

```
>> s = tcpip("0.0.0.0", 3000, 'NetworkRole', 'server')

   TCPIP Object : TCPIP-0.0.0.0

   Communication Settings
      RemotePort:         3000
      RemoteHost:         0.0.0.0
      Terminator:         'LF'
      NetworkRole:        server

   Communication State
      Status:             closed
      RecordStatus:       off

   Read/Write State
      TransferStatus:     idle
      BytesAvailable:     0
      ValuesReceived:     0
      ValuesSent:         0
```

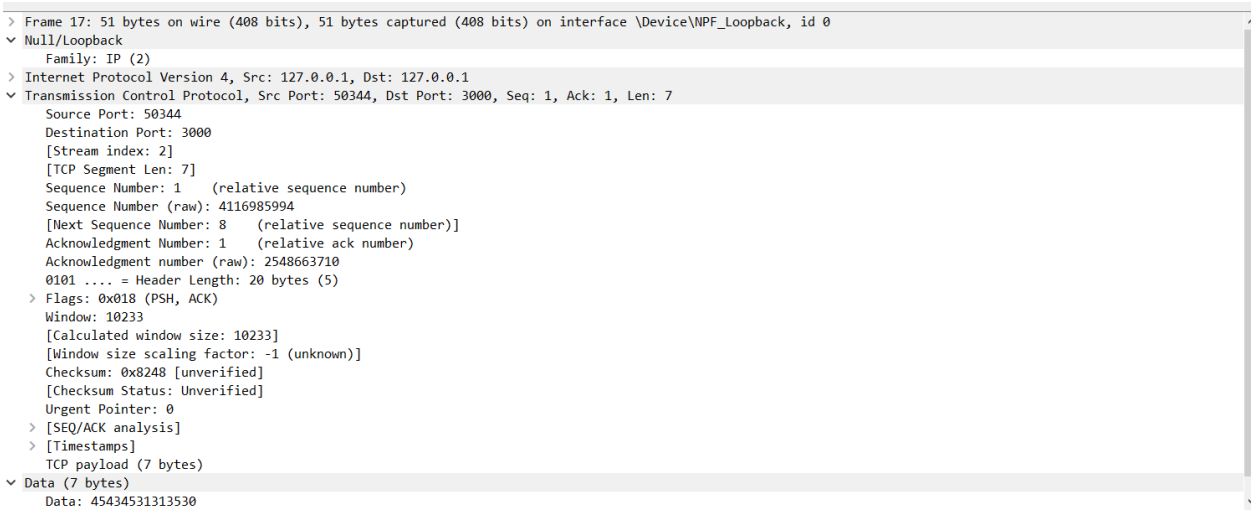
```
>> fopen(s)
>> fread(s)
Warning: The specified amount of data was not returned within the Timeout period.
'tcpip' unable to read all requested data. For more information on possible reasons, see TCPIP Read
Warnings.

ans =

    69
    67
    69
    49
    49
    53
    48

>> fclose(c)
Undefined function or variable 'c'.

>> fclose(s)
```

(b)



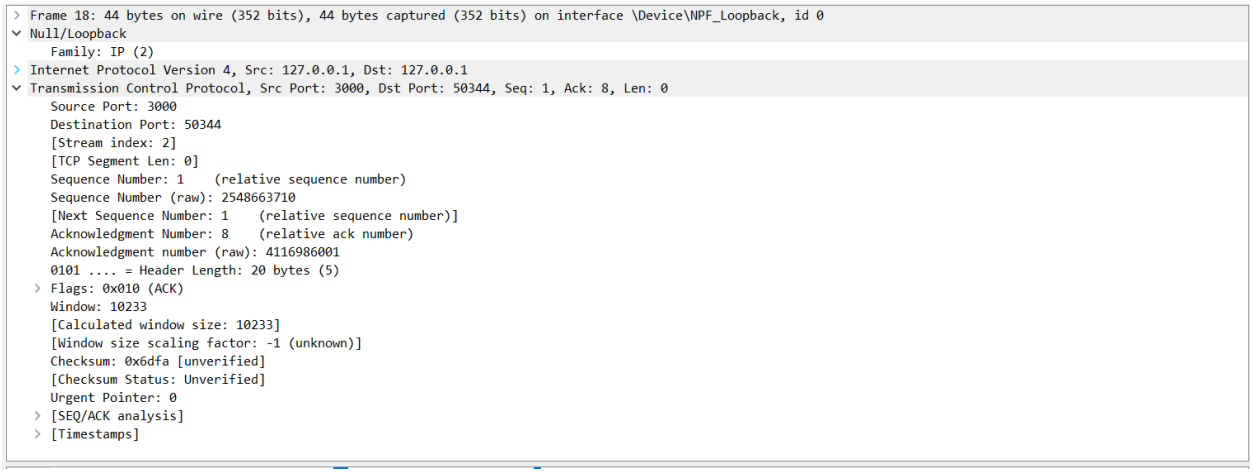

(c) The first three packets are for the initial connection setup, performing the “three way handshake” between source and destination.

(d)




Sequence number: 4116985994

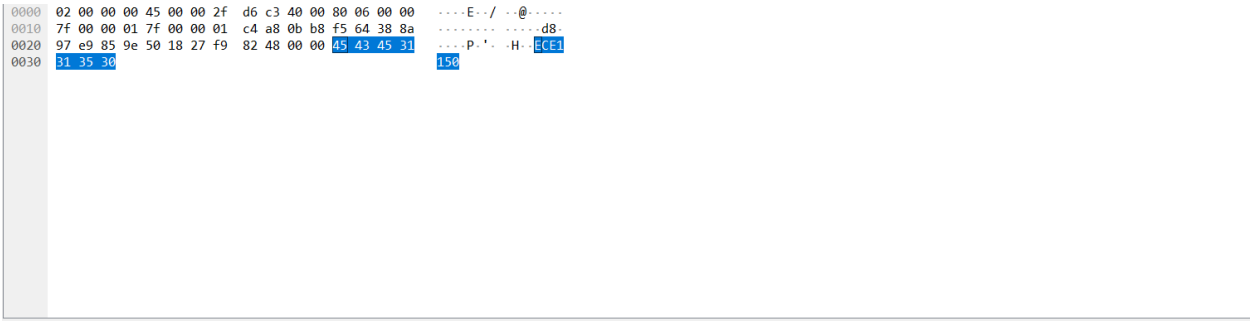
Acknowledgement number: 2548663710




Sequence number: 2548663710

Acknowledgement number: 4116986001

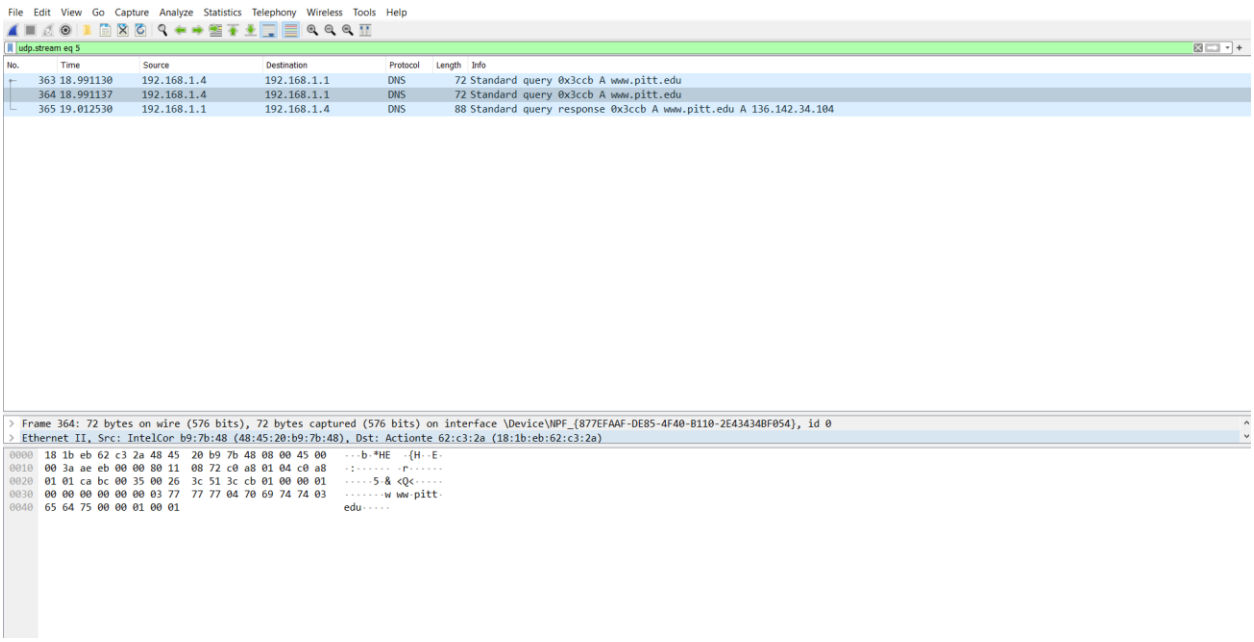
(e)



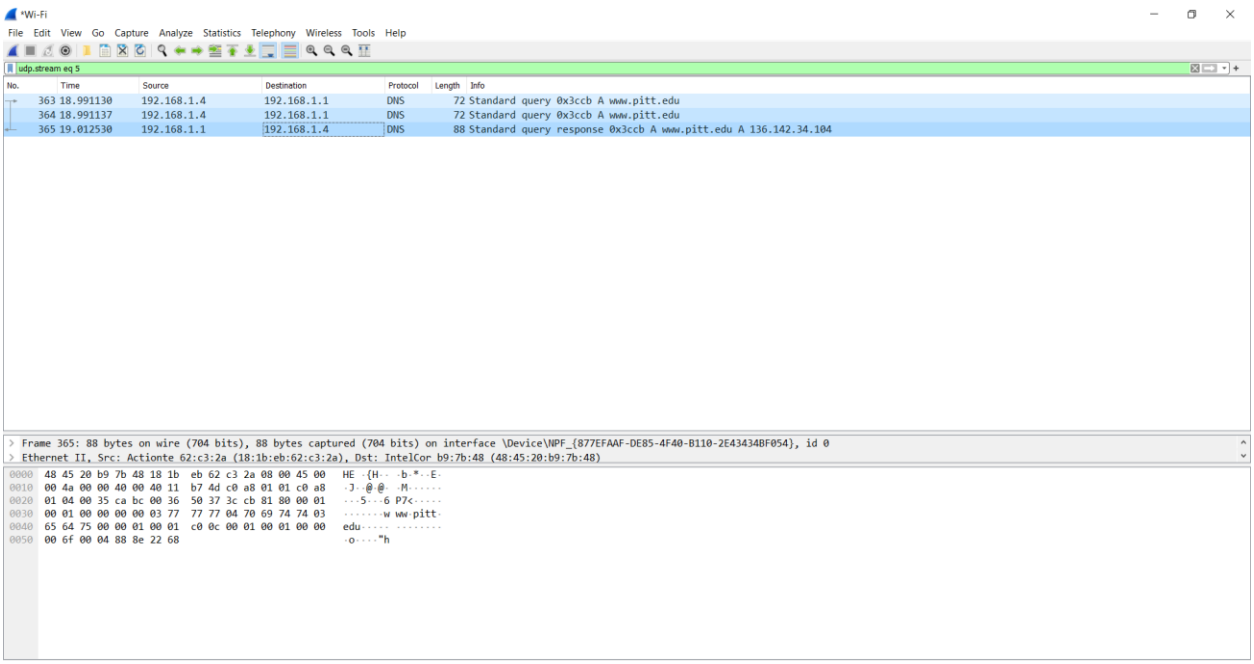

7.

(a)

Query packet:

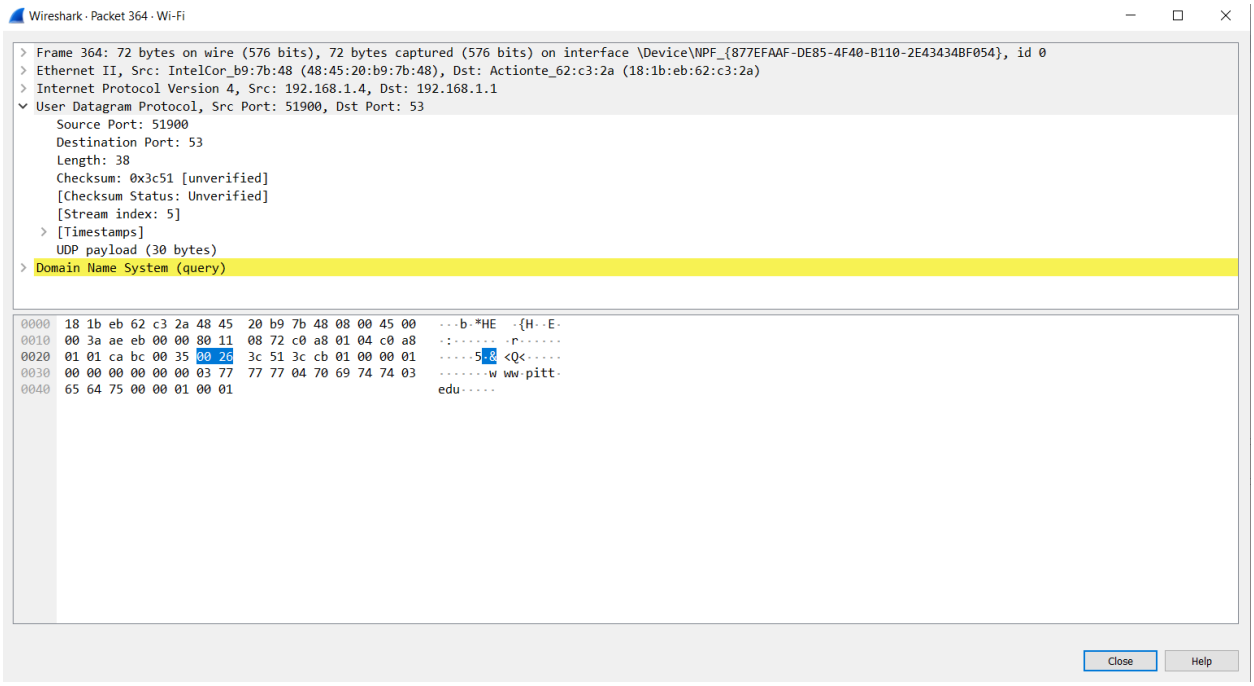



Response packet:

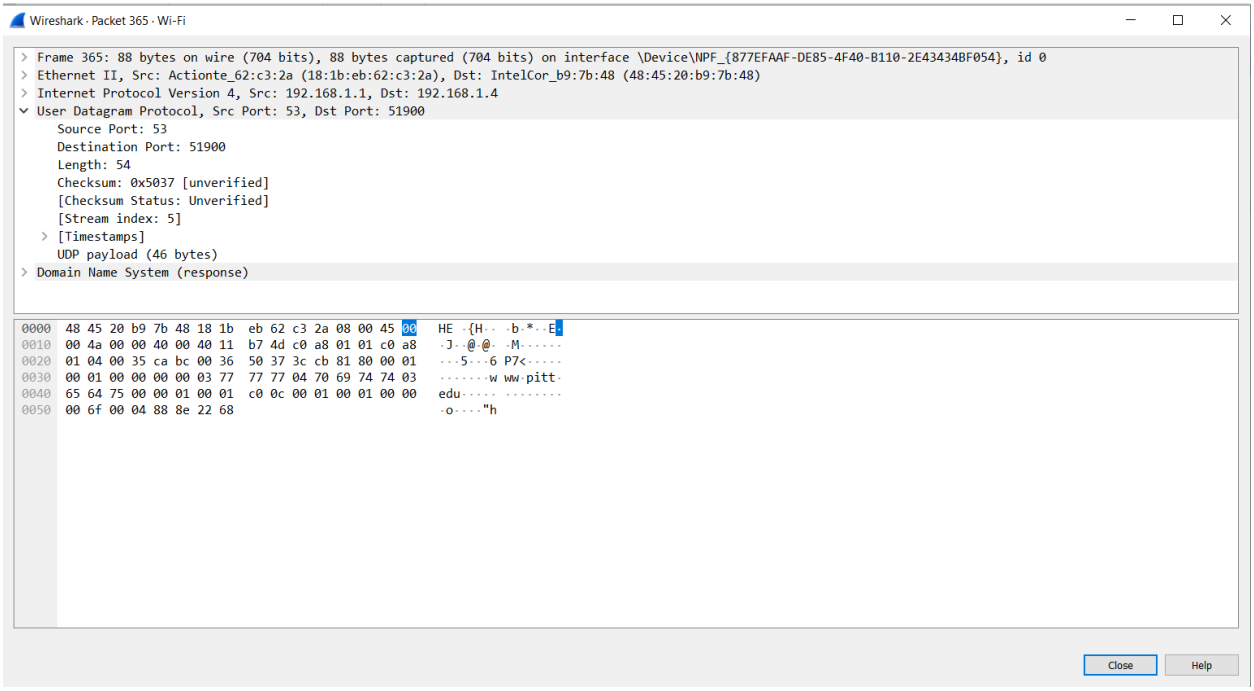



(b) They are sent over UDP.

(c) Query message (destination port = 53)




Response message (source port = 53)




(d) The IP address is 136.142.34.104

```
Answer RRs: 1
Authority RRs: 0
Additional RRs: 0
> Queries
v Answers
  v www.pitt.edu: type A, class IN, addr 136.142.34.104
      Name: www.pitt.edu
      Type: A (Host Address) (1)
      Class: IN (0x0001)
      Time to live: 111 (1 minute, 51 seconds)
      Data length: 4
      Address: 136.142.34.104
  [Request In: 363]
  [Time: 0.021400000 seconds]
```

```
0000  48 45 20 b9 7b 48 18 1b  eb 62 c3 2a 08 00 45 00   HE ·{H·· ·b·*··E·
0010  00 4a 00 00 40 00 40 11  b7 4d c0 a8 01 01 c0 a8   ·J··@·@· ·M·····
0020  01 04 00 35 ca bc 00 36  50 37 3c cb 81 80 00 01   ···5···6 P7<·····
0030  00 01 00 00 00 00 03 77  77 77 04 70 69 74 74 03   ·······w ww·pitt·
0040  65 64 75 00 00 01 00 01  c0 0c 00 01 00 01 00 00   edu····· ········
0050  00 6f 00 04 88 8e 22 68                           ·o····"h
```