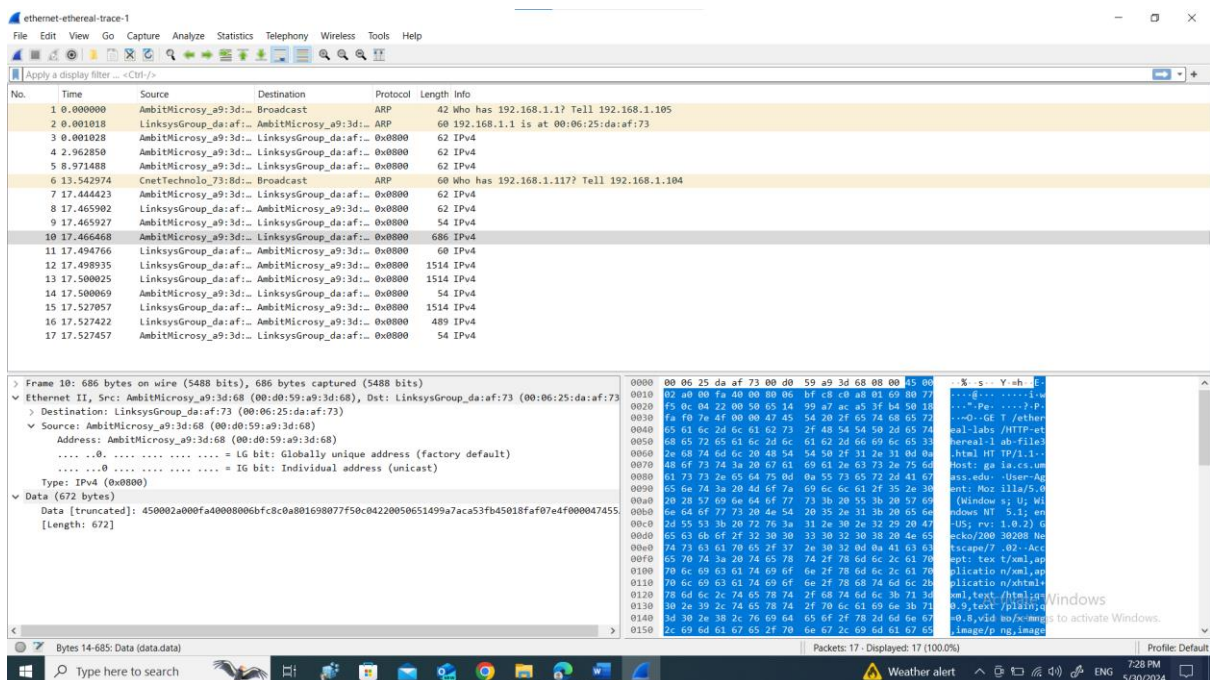


1. What is the 48-bit Ethernet address of your computer?



2. What is the 48-bit destination address in the Ethernet frame? Is this the Ethernet address of gaia.cs.umass.edu? (Hint: the answer is no). What device has this as its Ethernet address? [Note: this is an important question, and one that students sometimes get wrong. Re-read pages 468-469 in the text and make sure you understand the answer here.]

```

> Frame 10: 686 bytes on wire (5488 bits), 686 bytes captured (5488 bits)
▼ Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
  ▼ Destination: LinksysGroup_da:af:73 (00:06:25:da:af:73)
    Address: LinksysGroup_da:af:73 (00:06:25:da:af:73)
    ....0. .... = LG bit: Globally unique address (factory default)
    ....0. .... = IG bit: Individual address (unicast)
  ▼ Source: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    Address: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    ....0. .... = LG bit: Globally unique address (factory default)
    ....0. .... = IG bit: Individual address (unicast)
  Type: IPv4 (0x0800)
▼ Data (672 bytes)
  Data [truncated]: 450002a000fa40008006bfc8c0a801698077f50c04220050651499a7aca53fb45018faf07e4f000047455
  [Length: 672]

```

3. Give the hexadecimal value for the two-byte Frame type field. What upper layer protocol does this correspond to?

```

> Frame 10: 686 bytes on wire (5488 bits), 686 bytes captured (5488 bits)
▼ Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: LinksysGroup_da:af:73 (00:06:25:da:af:73)
  > Destination: LinksysGroup_da:af:73 (00:06:25:da:af:73)
  > Source: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
  Type: IPv4 (0x0800)
> Data (672 bytes)

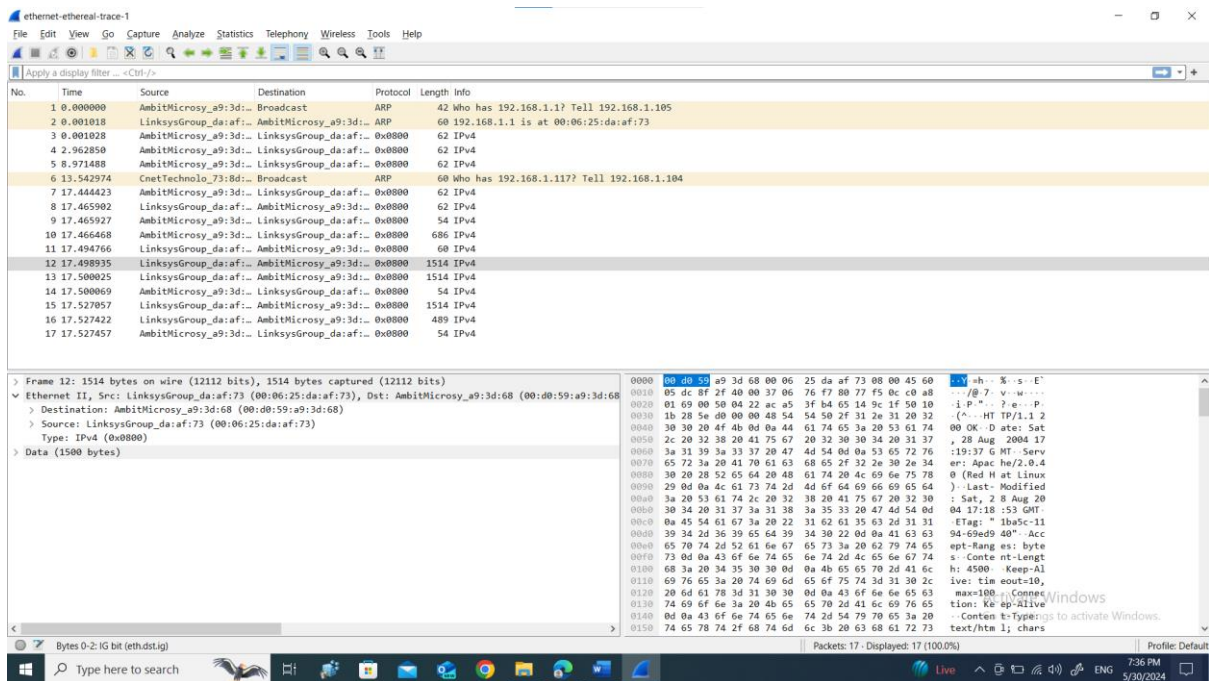
```

4. How many bytes from the very start of the Ethernet frame does the ASCII “G” in “GET” appear in the Ethernet frame?

| | | |
|------|---|--------------------|
| 0000 | 00 06 25 da af 73 00 d0 59 a9 3d 68 08 00 45 00 | ..%.s..Y.=h..E. |
| 0010 | 02 a0 00 fa 40 00 80 06 bf c8 c0 a8 01 69 80 77 |@... ..i.w |
| 0020 | f5 0c 04 22 00 50 65 14 99 a7 ac a5 3f b4 50 18 | ...".Pe.?.P. |
| 0030 | fa f0 7e 4f 00 00 47 45 54 20 2f 65 74 68 65 72 | ...~0..GET /ether |
| 0040 | 65 61 6c 2d 6c 61 62 73 2f 48 54 54 50 2d 65 74 | real-labs /HTTP-et |
| 0050 | 68 65 72 65 61 6c 2d 6c 61 62 2d 66 69 6c 65 33 | hereal-l ab-file3 |
| 0060 | 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d 0a | .html HT TP/1.1.. |
| 0070 | 48 6f 73 74 3a 20 67 61 69 61 2e 63 73 2e 75 6d | Host: ga ia.cs.um |
| 0080 | 61 73 73 2e 65 64 75 0d 0a 55 73 65 72 2d 41 67 | ass.edu. ·User-Ag |
| 0090 | 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61 2f 35 2e 30 | ent: Moz illa/5.0 |
| 00a0 | 20 28 57 69 6e 64 6f 77 73 3b 20 55 3b 20 57 69 | (Window s; U; Wi |
| 00b0 | 6e 64 6f 77 73 20 4e 54 20 35 2e 31 3b 20 65 6e | ndows NT 5.1; en |
| 00c0 | 2d 55 53 3b 20 72 76 3a 31 2e 30 2e 32 29 20 47 | -US; rv: 1.0.2) G |
| 00d0 | 65 63 6b 6f 2f 32 30 30 33 30 32 30 38 20 4e 65 | ecko/200 30208 Ne |
| 00e0 | 74 73 63 61 70 65 2f 37 2e 30 32 0d 0a 41 63 63 | tscape/7 .02·Acc |
| 00f0 | 65 70 74 3a 20 74 65 78 74 2f 78 6d 6c 2c 61 70 | ept: tex t/xml,ap |
| 0100 | 70 6c 69 63 61 74 69 6f 6e 2f 78 6d 6c 2c 61 70 | plicatio n/xml,ap |
| 0110 | 70 6c 69 63 61 74 69 6f 6e 2f 78 68 74 6d 6c 2b | plicatio n/xhtml+ |
| 0120 | 78 6d 6c 2c 74 65 78 74 2f 68 74 6d 6c 3b 71 3d | xml,text /html;q= |
| 0130 | 30 2e 39 2c 74 65 78 74 2f 70 6c 61 69 6e 3b 71 | 0.9,text /plain;q |
| 0140 | 3d 30 2e 38 2c 76 69 64 65 6f 2f 78 2d 6d 6e 67 | =0.8,vid eo/;img |
| 0150 | 2c 69 6d 61 67 65 2f 70 6e 67 2c 69 6d 61 67 65 | ,image/p ng,image |

|| Packets: 17 · Displaved: 17 (100.0%)

5. What is the value of the Ethernet source address? Is this the address of your computer, or of gaia.cs.umass.edu (Hint: the answer is no). What device has this as its Ethernet address?



6. What is the destination address in the Ethernet frame? Is this the Ethernet address of your computer?

```
> Frame 12: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
v Ethernet II, Src: LinksysGroup_da:af:73 (00:06:25:da:af:73), Dst: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
  > Destination: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
  > Source: LinksysGroup_da:af:73 (00:06:25:da:af:73)
  Type: IPv4 (0x0800)
  > Data (1500 bytes)
```

7. Give the hexadecimal value for the two-byte Frame type field. What upper layer protocol does this correspond to?

```
> Frame 12: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
v Ethernet II, Src: LinksysGroup_da:af:73 (00:06:25:da:af:73), Dst: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
  > Destination: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
  > Source: LinksysGroup_da:af:73 (00:06:25:da:af:73)
  Type: IPv4 (0x0800)
  > Data (1500 bytes)
```

8. How many bytes from the very start of the Ethernet frame does the ASCII “O” in “OK”

(i.e., the HTTP response code) appear in the Ethernet frame?

| | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------------|
| 00 | 00 | d0 | 59 | a9 | 3d | 68 | 00 | 06 | 25 | da | af | 73 | 08 | 00 | 45 | 60 | ..Y.=h..%.s..E` |
| 10 | 05 | dc | 8f | 2f | 40 | 00 | 37 | 06 | 76 | f7 | 80 | 77 | f5 | 0c | c0 | a8 | .../@.7. v..w.... |
| 20 | 01 | 69 | 00 | 50 | 04 | 22 | ac | a5 | 3f | b4 | 65 | 14 | 9c | 1f | 50 | 10 | .i.P."..?.e...P. |
| 30 | 1b | 28 | 5e | d0 | 00 | 00 | 48 | 54 | 54 | 50 | 2f | 31 | 2e | 31 | 20 | 32 | .(^...HT TP/1.1 2 |
| 40 | 30 | 30 | 20 | 4f | 4b | 0d | 0a | 44 | 61 | 74 | 65 | 3a | 20 | 53 | 61 | 74 | 00 OK..D ate: Sat |
| 50 | 2c | 20 | 32 | 38 | 20 | 41 | 75 | 67 | 20 | 32 | 30 | 30 | 34 | 20 | 31 | 37 | , 28 Aug 2004 17 |
| 60 | 3a | 31 | 39 | 3a | 33 | 37 | 20 | 47 | 4d | 54 | 0d | 0a | 53 | 65 | 72 | 76 | :19:37 G MT..Serv |
| 70 | 65 | 72 | 3a | 20 | 41 | 70 | 61 | 63 | 68 | 65 | 2f | 32 | 2e | 30 | 2e | 34 | er: Apac he/2.0.4 |
| 80 | 30 | 20 | 28 | 52 | 65 | 64 | 20 | 48 | 61 | 74 | 20 | 4c | 69 | 6e | 75 | 78 | 0 (Red H at Linux |
| 90 | 29 | 0d | 0a | 4c | 61 | 73 | 74 | 2d | 4d | 6f | 64 | 69 | 66 | 69 | 65 | 64 |)..Last- Modified |
| a0 | 3a | 20 | 53 | 61 | 74 | 2c | 20 | 32 | 38 | 20 | 41 | 75 | 67 | 20 | 32 | 30 | : Sat, 2 8 Aug 20 |
| b0 | 30 | 34 | 20 | 31 | 37 | 3a | 31 | 38 | 3a | 35 | 33 | 20 | 47 | 4d | 54 | 0d | 04 17:18 :53 GMT. |
| c0 | 0a | 45 | 54 | 61 | 67 | 3a | 20 | 22 | 31 | 62 | 61 | 35 | 63 | 2d | 31 | 31 | .ETag: " 1ba5c-11 |
| d0 | 39 | 34 | 2d | 36 | 39 | 65 | 64 | 39 | 34 | 30 | 22 | 0d | 0a | 41 | 63 | 63 | 94-69ed9 40"..Acc |
| e0 | 65 | 70 | 74 | 2d | 52 | 61 | 6e | 67 | 65 | 73 | 3a | 20 | 62 | 79 | 74 | 65 | ept-Rang es: byte |
| f0 | 73 | 0d | 0a | 43 | 6f | 6e | 74 | 65 | 6e | 74 | 2d | 4c | 65 | 6e | 67 | 74 | s..Conte nt-Lengt |
| 00 | 68 | 3a | 20 | 34 | 35 | 30 | 30 | 0d | 0a | 4b | 65 | 65 | 70 | 2d | 41 | 6c | h: 4500. .Keep-Al |
| 10 | 69 | 76 | 65 | 3a | 20 | 74 | 69 | 6d | 65 | 6f | 75 | 74 | 3d | 31 | 30 | 2c | ive: tim eout=10, |
| 20 | 20 | 6d | 61 | 78 | 3d | 31 | 30 | 30 | 0d | 0a | 43 | 6f | 6e | 6e | 65 | 63 | max=100. .Conne |
| 30 | 74 | 69 | 6f | 6e | 3a | 20 | 4b | 65 | 65 | 70 | 2d | 41 | 6c | 69 | 76 | 65 | tion: Ke ep-Alive |
| 40 | 0d | 0a | 43 | 6f | 6e | 74 | 65 | 6e | 74 | 2d | 54 | 79 | 70 | 65 | 3a | 20 | ..Conte nt-Typ |
| 50 | 74 | 65 | 78 | 74 | 2f | 68 | 74 | 6d | 6c | 3b | 20 | 63 | 68 | 61 | 72 | 73 | text/htm l; chars |

10. What are the hexadecimal values for the source and destination addresses in the Ethernet frame containing the ARP request message?

| | |
|---|---|
| > | Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) |
| ▼ | Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff) |
| > | Destination: Broadcast (ff:ff:ff:ff:ff:ff) |
| > | Source: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68) |
| | Type: ARP (0x0806) |
| > | Address Resolution Protocol (request) |

11. Give the hexadecimal value for the two-byte Ethernet Frame type field. What upper layer protocol does this correspond to?

| | |
|---|---|
| > | Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) |
| ▼ | Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff) |
| > | Destination: Broadcast (ff:ff:ff:ff:ff:ff) |
| > | Source: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68) |
| | Type: ARP (0x0806) |
| > | Address Resolution Protocol (request) |

12. a) How many bytes from the very beginning of the Ethernet frame does the ARP opcode field begin?


```

> Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
> Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    Sender IP address: 192.168.1.105
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.1.1

```

b) What is the value of the opcode field within the ARP-payload part of the Ethernet frame in which an ARP request is made?

Ans. 00 01

c) Does the ARP message contain the IP address of the sender?

```

> Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
> Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  > Source: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    Type: ARP (0x0806)
  > Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    Sender IP address: 192.168.1.105
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.1.1

```

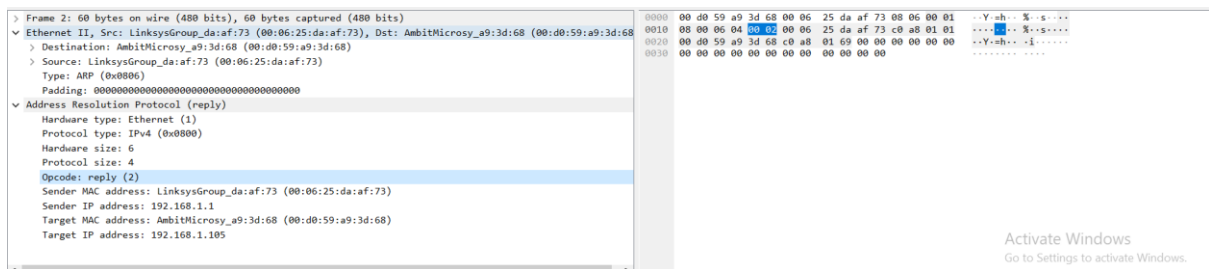
d) Where in the ARP request does the “question” appear – the Ethernet address of the machine whose corresponding IP address is being queried?

```

> Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
> Ethernet II, Src: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  > Source: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    Type: ARP (0x0806)
  > Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: AmbitMicrosy_a9:3d:68 (00:d0:59:a9:3d:68)
    Sender IP address: 192.168.1.105
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.1.1

```

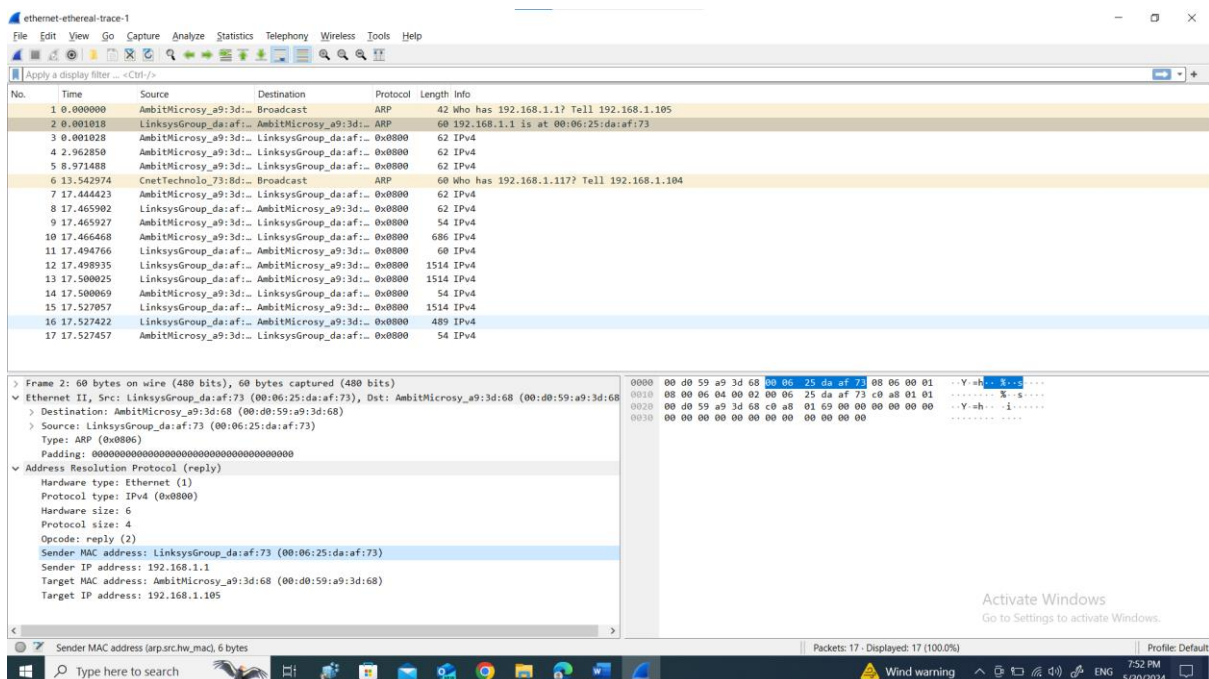
13. Now find the ARP reply that was sent in response to the ARP request. a) How many bytes from the very beginning of the Ethernet frame does the ARP opcode field begin?



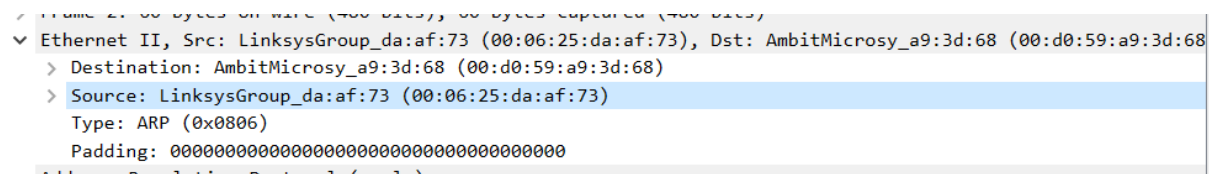
b) What is the value of the opcode field within the ARP-payload part of the Ethernet frame in which an ARP response is made?

Ans. 00 02

c) Where in the ARP message does the “answer” to the earlier ARP request appear – the IP address of the machine having the Ethernet address whose corresponding IP address is being queried?



14. What are the hexadecimal values for the source and destination addresses in the Ethernet frame containing the ARP reply message?



15. Open the ethernet-ethereal-trace-1 trace file in <http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip>. The first and second ARP packets in this trace correspond to an ARP request sent by the computer running Wireshark, and the ARP reply sent to the computer running Wireshark by the computer with the ARP-requested Ethernet address. But there is yet another computer on this network, as indicated by packet 6 – another ARP request. Why is there no ARP reply (sent in response to the ARP request in

packet 6) in the packet trace?

| | | | | | | |
|----|-----------|------------------------|------------------------|--------|------|---|
| 1 | 0.000000 | AmbitMicrosy_a9:3d:... | Broadcast | ARP | 42 | Who has 192.168.1.1? Tell 192.168.1.105 |
| 2 | 0.001018 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | ARP | 60 | 192.168.1.1 is at 00:06:25:da:af:73 |
| 3 | 0.001028 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 62 | IPv4 |
| 4 | 2.962850 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 62 | IPv4 |
| 5 | 8.971488 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 62 | IPv4 |
| 6 | 13.542974 | CnetTechnolo_73:8d:... | Broadcast | ARP | 60 | Who has 192.168.1.117? Tell 192.168.1.104 |
| 7 | 17.444423 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 62 | IPv4 |
| 8 | 17.465902 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | 0x0800 | 62 | IPv4 |
| 9 | 17.465927 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 54 | IPv4 |
| 10 | 17.466468 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 686 | IPv4 |
| 11 | 17.494766 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | 0x0800 | 60 | IPv4 |
| 12 | 17.498935 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | 0x0800 | 1514 | IPv4 |
| 13 | 17.500025 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | 0x0800 | 1514 | IPv4 |
| 14 | 17.500069 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 54 | IPv4 |
| 15 | 17.527057 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | 0x0800 | 1514 | IPv4 |
| 16 | 17.527422 | LinksysGroup_da:af:... | AmbitMicrosy_a9:3d:... | 0x0800 | 489 | IPv4 |
| 17 | 17.527457 | AmbitMicrosy_a9:3d:... | LinksysGroup_da:af:... | 0x0800 | 54 | IPv4 |