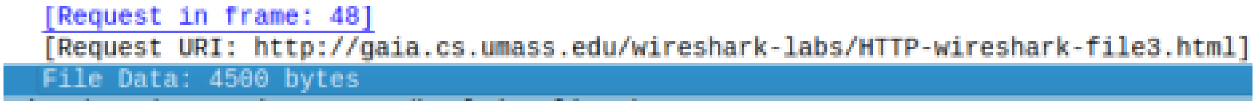
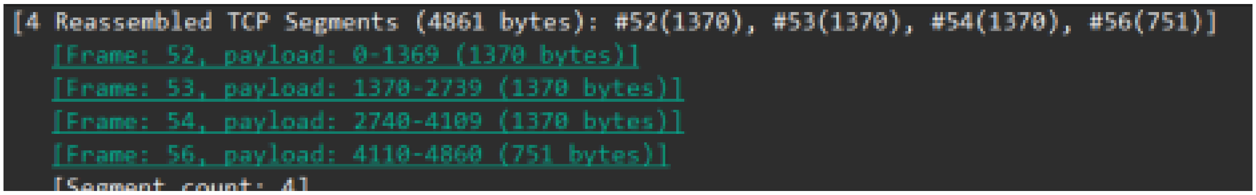
Part 1:

1. Source Address: 192.168.1.100
   Destination Address: 128.119.245.12
   Source Port: 63917
   Destination Port: 80
2. gaia.cs.umass.edu
3. Persistent, as indicated by **Connection: keep-alive\r\n**
4. Packet number: 56, File data: 4500 bytes



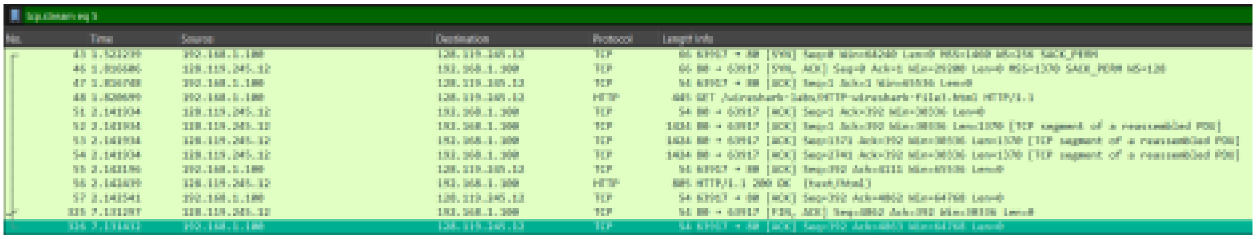
```
    [Request in frame: 48]
    [Request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file3.html]
    File Data: 4500 bytes
```

5. 4 data carrying TCP segments, packet number 56



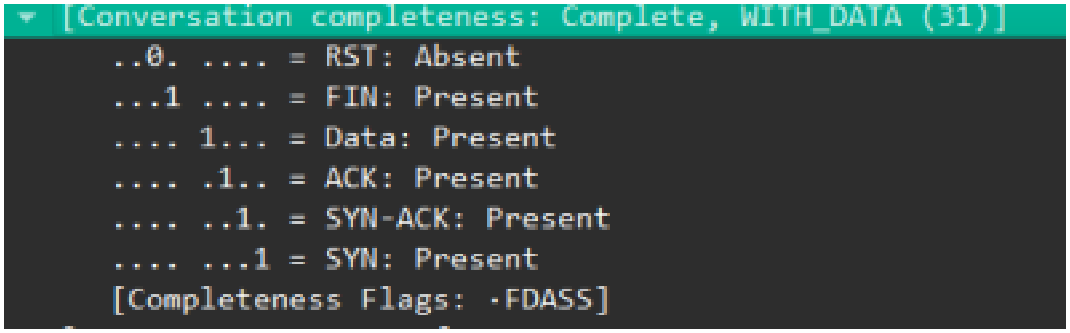
```
[4 Reassembled TCP Segments (4861 bytes): #52(1370), #53(1370), #54(1370), #56(751)]
    [Frame: 52, payload: 0-1369 (1370 bytes)]
    [Frame: 53, payload: 1370-2739 (1370 bytes)]
    [Frame: 54, payload: 2740-4109 (1370 bytes)]
    [Frame: 56, payload: 4110-4860 (751 bytes)]
    [Segment count: 4]
```

6. 11 TCP packets + 2 HTTP



```
tcp.stream eq 3
No.   Time      Source          Destination     Protocol Length Info
 45 1.523299  192.168.1.100   128.119.245.12  TCP      66 63917 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
 46 1.816686  128.119.245.12  192.168.1.100   TCP      66 80 → 63917 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1370 SACK_PERM WS=128
 47 1.830788  192.168.1.100   128.119.245.12  TCP      54 63917 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
 48 1.830699  192.168.1.100   128.119.245.12  HTTP    445 GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1
 51 2.141934  128.119.245.12  192.168.1.100   TCP      54 80 → 63917 [ACK] Seq=1 Ack=392 Win=30336 Len=0
 52 2.141934  128.119.245.12  192.168.1.100   TCP    1424 80 → 63917 [ACK] Seq=1 Ack=392 Win=30336 Len=1370 [TCP segment of a reassembled PDU]
 53 2.141934  128.119.245.12  192.168.1.100   TCP    1424 80 → 63917 [ACK] Seq=1371 Ack=392 Win=30336 Len=1370 [TCP segment of a reassembled PDU]
 54 2.141934  128.119.245.12  192.168.1.100   TCP    1424 80 → 63917 [ACK] Seq=2741 Ack=392 Win=30336 Len=1370 [TCP segment of a reassembled PDU]
 55 2.142196  192.168.1.100   128.119.245.12  TCP      54 63917 → 80 [ACK] Seq=392 Ack=4111 Win=65536 Len=0
 56 2.142699  128.119.245.12  192.168.1.100   HTTP    805 HTTP/1.1 200 OK  (text/html)
 57 2.142541  192.168.1.100   128.119.245.12  TCP      54 63917 → 80 [ACK] Seq=392 Ack=4862 Win=64768 Len=0
325 7.131297  128.119.245.12  192.168.1.100   TCP      54 80 → 63917 [FIN, ACK] Seq=4862 Ack=392 Win=30336 Len=0
326 7.131412  192.168.1.100   128.119.245.12  TCP      54 63917 → 80 [ACK] Seq=392 Ack=4863 Win=64768 Len=0
```

7. Packet number 48



```
▾ [Conversation completeness: Complete, WITH_DATA (31)]
      ..0. .... = RST: Absent
      ...1 .... = FIN: Present
      .... 1... = Data: Present
      .... .1.. = ACK: Present
      .... ..1. = SYN-ACK: Present
      .... ...1 = SYN: Present
      [Completeness Flags: ·FDASS]
```

There is no difference between the flag values between the HTTP GET and HTTP OK packets.

8. No
9. From its browser/system-level DNS cache

Part 2:

10. d8:5e:d3:54:2f:a7
11. UDP
12.

DHCP message	Source IP Destination IP

DHCP Discover	0.0.0.0 255.255.255.255
DHCP Offer	10.250.61.250 10.250.61.60
DHCP Request	0.0.0.0 255.255.255.255
DHCP ACK	10.250.61.250 10.250.61.60

13. 10.250.61.250 (based on DHCP Offer and ACK packets)
14. a-ii, b-iii, c-ii, d-iii
15. Option: (50) Requested IP Address (10.250.61.42) (in Discover packet) Option: (50) Requested IP Address (10.250.61.60) (in Request packet)
16. No, since
    DHCP Server Identifier: 10.250.61.250
    Domain Name Server: 10.250.200.3
    Router: 10.250.61.250
17. No, because Domain Name Server: 10.250.200.3 does not belong to the client's subnet 10.250.61.X

Part 3:

18. ICMP
19. On receiving **Type: 0 (Echo (ping) reply)**, the client stops sending additional ICMP probes with higher TTL values.
20. Type: 8 (Echo (ping) request)
21. Type: 11 (Time-to-live exceeded)
    Type: 0 (Echo (ping) reply)
22. 10.250.61.113
    10.250.61.250
    10.240.0.1
    10.240.240.1
    103.120.31.121
    103.120.29.73
    103.120.29.72
    72.14.209.113
    142.250.209.75
    142.250.62.66
    72.14.232.34
    192.178.110.105
    209.85.242.111

172.217.166.68

23. The ICMP error message carries the first 8 bytes of the IP Datagram causing the error.

Part 4:

24. TLSv1.2 and TLSv1.3

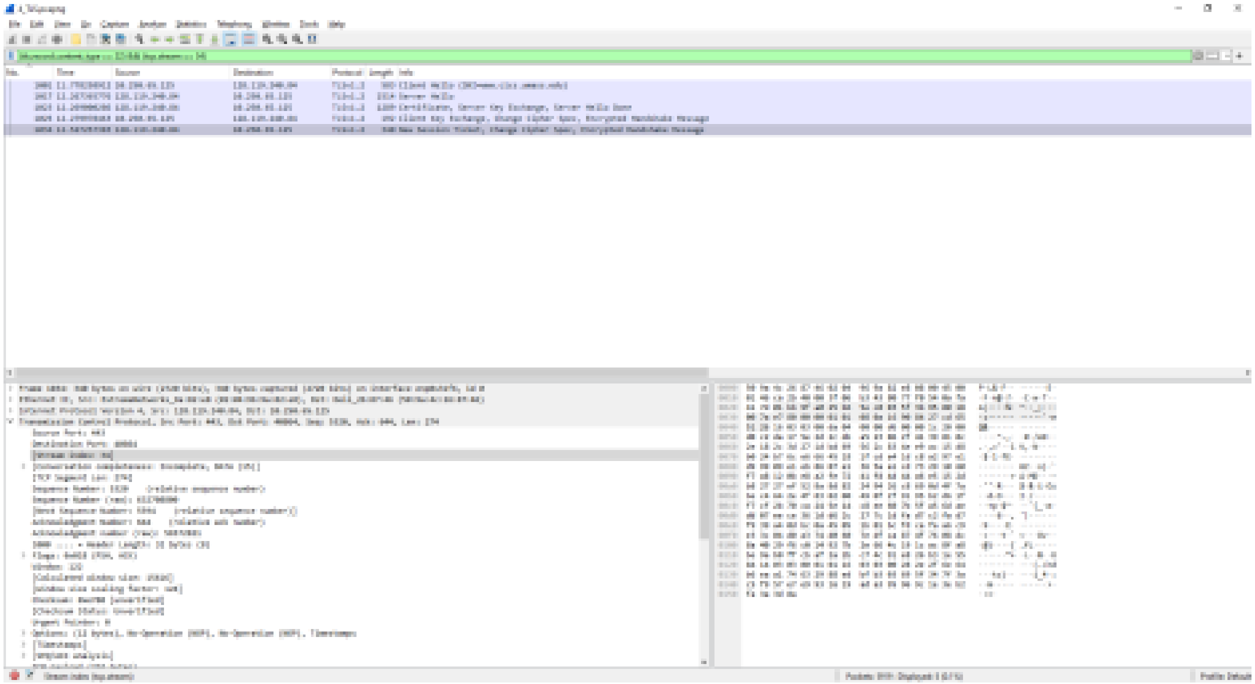
    TLSv1.2

25. 393

26. 17

    TLS_AES_128_GCM_SHA256 (0x1301)

27. 5



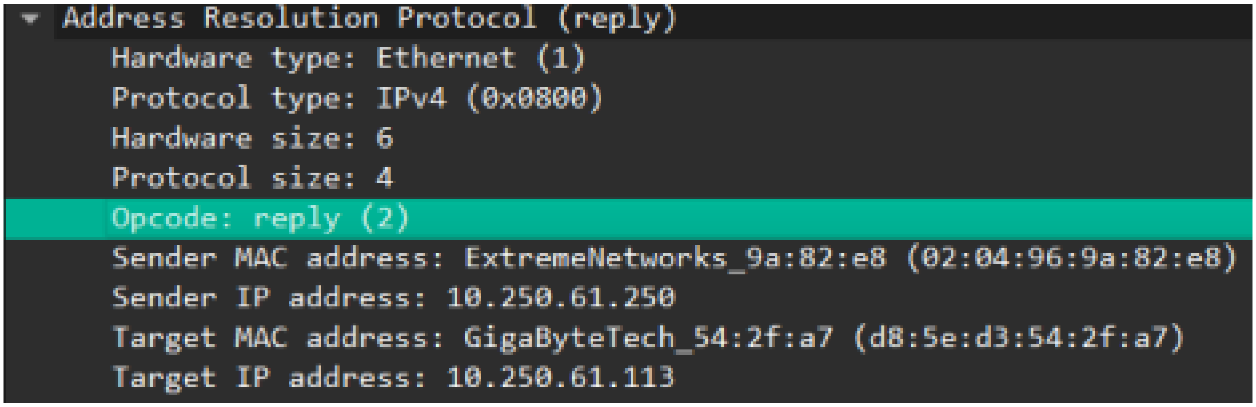
Part 5:

28. d8:5e:d3:54:2f:a7

29. Cannot be determined from the given trace

30. 28 bytes

31.



```
▾ Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: ExtremeNetworks_9a:82:e8 (02:04:96:9a:82:e8)
    Sender IP address: 10.250.61.250
    Target MAC address: GigaByteTech_54:2f:a7 (d8:5e:d3:54:2f:a7)
    Target IP address: 10.250.61.113
```

Hardware type: Ethernet (1) – 2 bytes

Protocol type: IPv4 (0x0800) - 2 bytes
Hardware size: 6 – 1 byte
Protocol size: 4 -1 byte
Opcode: reply (2) – 2 bytes
Sender MAC address: ExtremeNetworks_9a:82:e8 (02:04:96:9a:82:e8) – 6 bytes
Sender IP address: 10.250.61.250 -4 bytes
Target MAC address: Giga-Byt_54:2f:a7 (d8:5e:d3:54:2f:a7) – 6 bytes
Target IP address: 10.250.61.113 – 4 bytes

32. After 20 bytes

Part 6:

33. 00:17:f2:98:f0:6f
    IP Address of the client interface cannot be determined from the given packet trace.
34. 00:16:b6:e3:e9:8d
    IP Address of the WiFi AP interface cannot be determined from the given packet trace.
35.
    a. Source address: Apple_98:f0:6f (00:17:f2:98:f0:6f)
       Destination address: CiscoLinksys_e3:e9:8d (00:16:b6:e3:e9:8d)
       BSS Id: CiscoLinksys_e3:e9:8f (00:16:b6:e3:e9:8f)
    b. 1478 bytes
36. 2462 or 2.462GHz. Also called as “802.11 b/g channel 11”
37. Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 18, 24, 36, 54,
[Mbit/sec] 38. wlan.fc.type==1(Acknowledgement frame) → 1391
    wlan.fc.type==2(Data frame) → 1783
    wlan.fc.type=="management frame" → 557 frames
39. Filter: wlan.fc.type==2 && wlan.fc.retry==0
    Total number of data frames “wlan.fc.type==2” = 1783
    Number of transmission frames “wlan.fc.type==2 && wlan.fc.retry==0” = 1430
    Number of retransmission frames = 1783 - 1430 = 353

NS3 Answers:

40. Nodes, Application, Channels, Network Devices, Topology helpers
41. NetAnim