`DEPARTMENT OF INFORMATION TECHNOLOGY

COMPUTER NETWORKING LAB

LAB3: 18/11/2022

Marks : 10 Marks

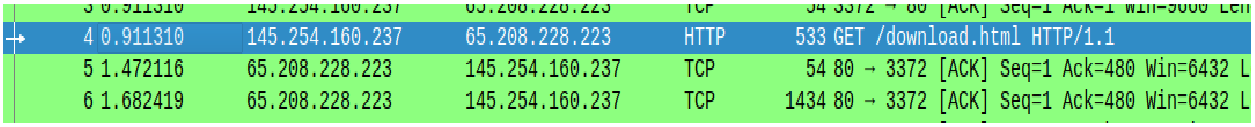
Objective

To understand the concept Packet headers at various layers

Download the http.pcap file from moodle.

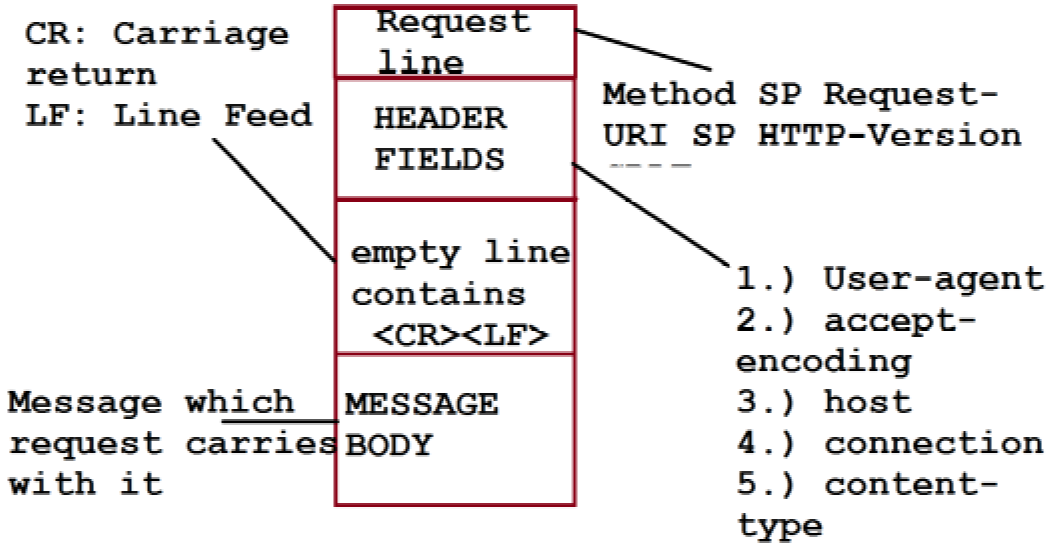
Open the file and note down and understand the following things.

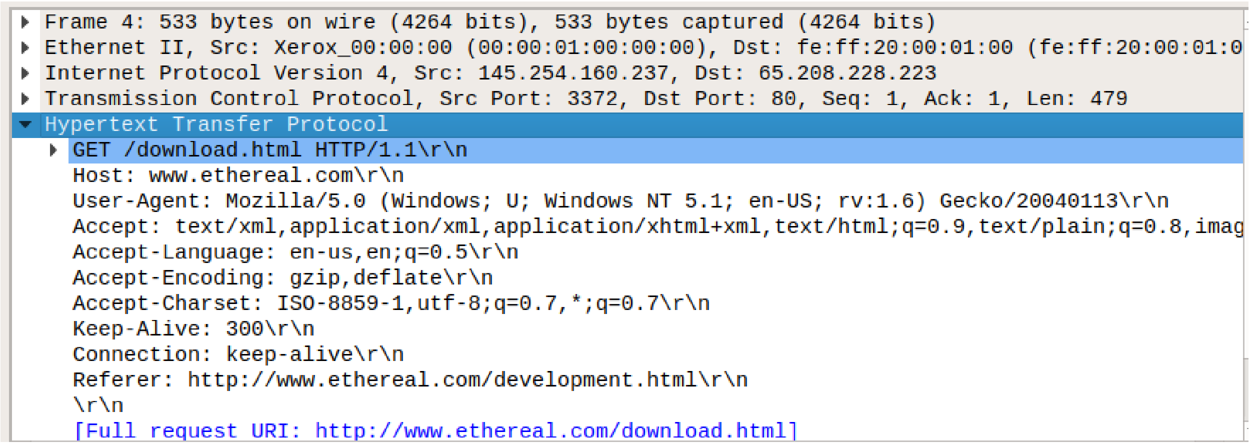
Click on following http request to understand the headers :



```
  3 0.911310   145.254.160.237   65.208.228.223    TCP     54 3372 → 80 [ACK] Seq=1 Ack=1 Win=9660 Len
→ 4 0.911310   145.254.160.237   65.208.228.223    HTTP   533 GET /download.html HTTP/1.1
  5 1.472116   65.208.228.223    145.254.160.237   TCP     54 80 → 3372 [ACK] Seq=1 Ack=480 Win=6432 L
  6 1.682419   65.208.228.223    145.254.160.237   TCP   1434 80 → 3372 [ACK] Seq=1 Ack=480 Win=6432 L
```

http request header





```
▶ Frame 4: 533 bytes on wire (4264 bits), 533 bytes captured (4264 bits)
▶ Ethernet II, Src: Xerox_00:00:00 (00:00:01:00:00:00), Dst: fe:ff:20:00:01:00 (fe:ff:20:00:01:0
▶ Internet Protocol Version 4, Src: 145.254.160.237, Dst: 65.208.228.223
▶ Transmission Control Protocol, Src Port: 3372, Dst Port: 80, Seq: 1, Ack: 1, Len: 479
▼ Hypertext Transfer Protocol
  ▶ GET /download.html HTTP/1.1\r\n
    Host: www.ethereal.com\r\n
    User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.6) Gecko/20040113\r\n
    Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,imag
    Accept-Language: en-us,en;q=0.5\r\n
    Accept-Encoding: gzip,deflate\r\n
    Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
    Keep-Alive: 300\r\n
    Connection: keep-alive\r\n
    Referer: http://www.ethereal.com/development.html\r\n
    \r\n
    [Full request URI: http://www.ethereal.com/download.html]
```

Q1. Note down the following from Message of HTTP request: [2 marks]

Request Header :

GET /download.html HTTP/1.1\r\n

[Expert Info (Chat/Sequence): GET /download.html HTTP/1.1\r\n]
Request Method: GET
Request URI: /download.html
Request Version: HTTP/1.1

Header fields:

User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.6) Gecko/20040113\r\n

Accept:text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/png,image/jpeg,image/gif;q=0.2,*/*;q=0.1\r\n

Accept-Language: en-us,en;q=0.5\r\n

Accept-Encoding: gzip,deflate\r\n

Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n

Keep-Alive: 300\r\n

Connection: keep-alive\r\n

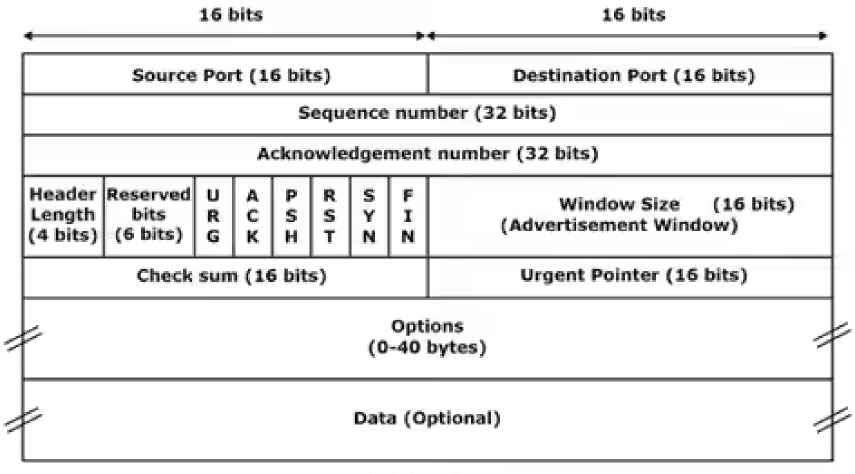
Reference: http://www.ethereal.com/development.html\r\n

\r\n
[Full request URI: http://www.ethereal.com/download.html]
[HTTP request 1/1]
[Response in frame: 38]

Q2: Write the relevance of these header fields in HTTP request. [2 marks]

The HTTP request is sent to Transport Layer and TCP layer adds its own header for communication.

The format of TCP header is as follows:



TCP Header

A2.

The relevance of the header files in HTTP request are as follows:

User Agent: The user agent is an HTTP header that web browsers and other web applications use to identify themselves and their capabilities. User-Agent string is often used for content negotiation, where the origin server selects suitable content or operating parameters for the response. The web web security software captures and logs user agent data when users browse the Internet.

Accept: This HTTP header indicates which content types, expressed as MIME types, the client can understand. The server used content negotiation to select one of the proposals and informs the client of the choice with the Content-Type response header.

Accept Language: The Accept-Language request HTTP header indicates the natural language and locates that the client is present. Accept Language tells the server about all the languages the client can understand

Accept Encoding: The accept encoding request HTTP header indicates the content encoding(usually a compression algorithm) that the client can understand. The accept-encoding restricts the content-codings that are acceptable in the response.

Accept Charset: The HTTP Accept-Charset is a request type header. This header is used to indicate what character sets are acceptable for the response from the server. The accept-charset header specifies the character encodings which are accepted by the client and this header also allows a user-agent to specify the charsets it supports.

Keep alive: This is a general header, which allows the sender to hint about how the connection may be used to set a timeout and a maximum amount of requests.

Connection: This controls whether the network connection stays open after the current transaction finishes. If the value sent is keep-alive, then the connection remains persistent.

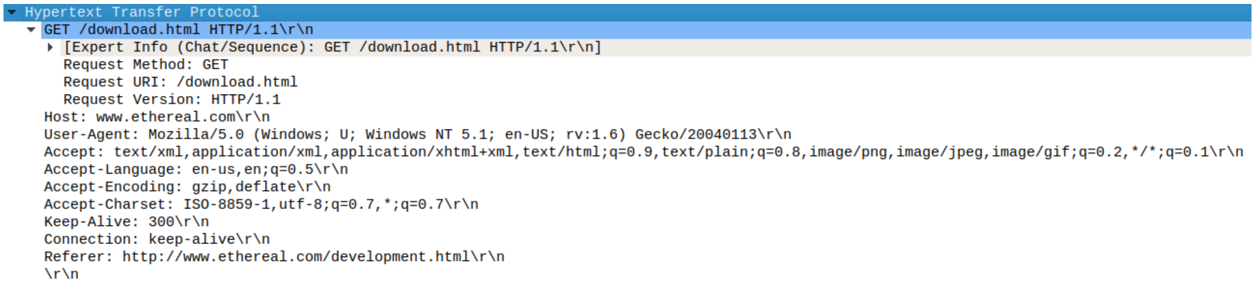
Reference: This HTTP request header contains the absolute or partial address from which a resource has been requested. It allows a server to identify referring pages that people are visiting from or where requested resources are being used.

Q3. From the pcap file click on Transmission Control protocol and identify the TCP header fields. Write its relevance in the header. Fill the table with details as shown for first field. [2 marks]

<table>
<tr><td colspan="8"><b>Source Port: 3372</b></td><td><b>Destination port: 80</b></td></tr>
<tr><td colspan="9"><b>Sequence Number: 1</b></td></tr>
<tr><td colspan="9"><b>Acknowledge number: 1</b></td></tr>
<tr><td>HL:
20 bytes</td><td>RES
000</td><td>URG
0</td><td>ACK
1</td><td>PSH
1</td><td>RST
0</td><td>SYN
0</td><td>FIN
0</td><td><b>Window Size: 9660</b></td></tr>
<tr><td colspan="8"><b>Checksum: 0xa958 [unverified]</b></td><td><b>Urgent pointer: 0</b></td></tr>
<tr><td colspan="9"><b>Options:</b></td></tr>
<tr><td colspan="9"><b>Data:</b>
47 45 54 20 2f 64 6f 77 6e 6c 6f 61 64 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d 0a 48 6f 73 74 3a
20 77 77 77 2e 65 74 68 65 72 65 61 6c 2e 63 6f 6d 0d 0a 55 73 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a
69 6c 6c 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35
2e 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 36 29 20 47 65 63 6b 6f 2f 32 30 30 34 30 31 31 33
0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 6d 6c
2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 68 74 6d 6c 2b 78 6d 6c 2c 74 65 78 74 2f 68 74 6d 6c 3b
71 3d 30 2e 39 2c 74 65 78 74 2f 70 6c 61 69 6e 3b 71 3d 30 2e 38 2c 69 6d 61 67 65 2f 70 6e 67 2c
69 6d 61 67 65 2f 6a 70 65 67 2c 69 6d 61 67 65 2f 67 69 66 3b 71 3d 30 2e 32 2c 2a 2f 2a 3b 71 3d
30 2e 31 0d 0a 41 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a 20 65 6e 2d 75 73 2c 65 6e 3b 71 3d
30 2e 35 0d 0a 41 63 63 65 70 74 2d 45 6e 63 6f 64 69 6e 67 3a 20 67 7a 69 70 2c 64 65 66 6c 61 74
65 0d 0a 41 63 63 65 70 74 2d 43 68 61 72 73 65 74 3a 20 49 53 4f 2d 38 38 35 39 2d 31 2c 75 74 66
2d 38 3b 71 3d 30 2e 37 2c 2a 3b 71 3d 30 2e 37 0d 0a 4b 65 65 70 2d 41 6c 69 76 65 3a 20 33 30 30</td></tr>
</table>

```
0d 0a 43 6f 6e 6e 65 63 74 69   6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0a   52 65 66 65 72 65 72
3a 20 68 74 74 70 3a 2f 2f    77 77 77 2e 65 74 68 65 72 65 61 6c 2e 63 6f 6d   2f 64 65 76 65 6c 6f 70 6d
65 6e 74 2e 68 74 6d   6c 0d 0a 0d 0a
```

The data part in ASCII is as follows:



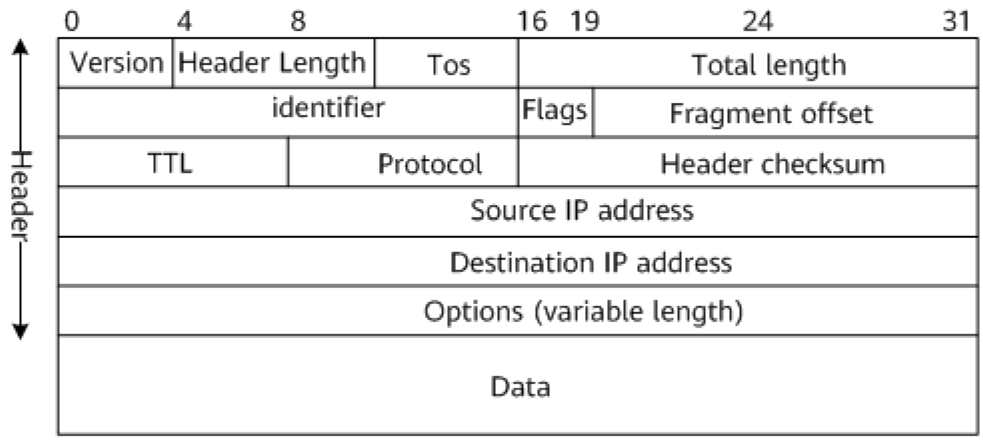
```
▾ Hypertext Transfer Protocol
  ▾ GET /download.html HTTP/1.1\r\n
    ▸ [Expert Info (Chat/Sequence): GET /download.html HTTP/1.1\r\n]
      Request Method: GET
      Request URI: /download.html
      Request Version: HTTP/1.1
    Host: www.ethereal.com\r\n
    User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.6) Gecko/20040113\r\n
    Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/png,image/jpeg,image/gif;q=0.2,*/*;q=0.1\r\n
    Accept-Language: en-us,en;q=0.5\r\n
    Accept-Encoding: gzip,deflate\r\n
    Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
    Keep-Alive: 300\r\n
    Connection: keep-alive\r\n
    Referer: http://www.ethereal.com/development.html\r\n
    \r\n
```

Find the relevance of each field and write at least one or two sentence about it.

Answer: Written in A2.

After the TCP header is attached, The segment is sent to Network layer and It attaches header for routing.

The format of IPv4 is as follows:



A3. The TCP header fields and their relevance are as follows:

Source port: A source port is the TCP or UDP number used by a program to send data to another program on one end.

Destination port: A destination port is the TCP or UDP number used by a program on one side of communication to receive data from another program on the other end.

Sequence number: It is a 32 bit field that indicates how much data is sent during the TCP session.

Acknowledgement number: It is a 32 bit field used by the receiver to request the next TCP segment.

Header Length: A 4 bit data offset field which indicates the length of the TCP header so that the user knows the beginning of the data.

Flags: There are 9 bits for flags, called control bits. We use them to establish connections, send data and terminate connections:

URG: urgent pointer. It specifies the packet contains urgent data.

ACK: Used for acknowledgment.

PSH: This is the push function. It tells to push data into application layer

RST: This resets the connection, when you receive this you have to terminate the connection right away. Can say used to tear down a connection.

SYN: Used to synchronize connection and for a 3 way handshake

FIN: This is used to finish the TCP connection.

Window: The 16 bit window field specifies how many bytes the receiver is willing to receive.

Checksum: It is a simple error detection mechanism to determine the integrity of the data transmitted over a network. Communication protocols like TCP/IP/UDP implement this scheme in order to determine whether the received data is corrupted along the network.

Urgent pointer: These 16 bits are used when the URG bit has been set, the urgent pointer is used to indicate where the urgent data ends.

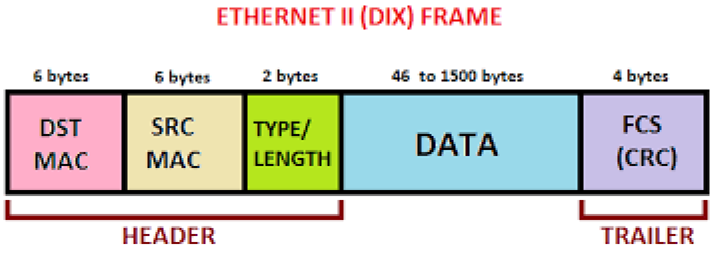
Options: This field is optional and can be anywhere between 0 and 320 bits.

Q4: Find the IPv4 fields for HTTP request and find their relevance [2marks]

<table>
<tr><td colspan="3">Version:
4</td><td colspan="3">Header Length:
20 bytes (5)</td><td colspan="2">ToS:
0x00</td><td colspan="2">Total Length: 519</td></tr>
<tr><td colspan="8">Identifier: 0x0f45 (3909)</td><td>Flags: 0x40</td><td>Fragment Offset: 0</td></tr>
<tr><td colspan="3">TTL: 128</td><td colspan="5">Protocol: TCP(6)</td><td colspan="2">Header Checksum: 0x9010</td></tr>
<tr><td colspan="10">Source IP Address
145.254.160.237</td></tr>
<tr><td colspan="10">Destination IP Address
65.208.228.223</td></tr>
<tr><td colspan="8">Source Port: 3372</td><td colspan="2">Destination port: 80</td></tr>
<tr><td colspan="10">Sequence Number: 1</td></tr>
<tr><td colspan="10">Acknowledge number: 1</td></tr>
<tr><td>HL:</td><td>RES
000</td><td>URG
0</td><td>ACK
1</td><td>PSH
1</td><td>RST
0</td><td>SYN
0</td><td>FIN
0</td><td colspan="2">Window Size: 9660</td></tr>
</table>

20 bytes								
Checksum: 0xa958								**Urgent pointer: 0**
Options:								
Data: 47 45 54 20 2f 64 6f 77 6e 6c 6f 61 64 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 77 77 77 2e 65 74 68 65 72 65 61 6c 2e 63 6f 6d 0d 0a 55 73 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 36 29 20 47 65 63 6b 6f 2f 32 30 30 34 30 31 31 33 0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 68 74 6d 6c 2b 78 6d 6c 2c 74 65 78 74 2f 68 74 6d 6c 3b 71 3d 30 2e 39 2c 74 65 78 74 2f 70 6c 61 69 6e 3b 71 3d 30 2e 38 2c 69 6d 61 67 65 2f 70 6e 67 2c 69 6d 61 67 65 2f 6a 70 65 67 2c 69 6d 61 67 65 2f 67 69 66 3b 71 3d 30 2e 32 2c 2a 2f 2a 3b 71 3d 30 2e 31 0d 0a 41 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a 20 65 6e 2d 75 73 2c 65 6e 3b 71 3d 30 2e 35 0d 0a 41 63 63 65 70 74 2d 45 6e 63 6f 64 69 6e 67 3a 20 67 7a 69 70 2c 64 65 66 6c 61 74 65 0d 0a 41 63 63 65 70 74 2d 43 68 61 72 73 65 74 3a 20 49 53 4f 2d 38 38 35 39 2d 31 2c 75 74 66 2d 38 3b 71 3d 30 2e 37 2c 2a 3b 71 3d 30 2e 37 0d 0a 4b 65 65 70 2d 41 6c 69 76 65 3a 20 33 30 30 0d 0a 43 6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0a 52 65 66 65 72 65 72 3a 20 68 74 74 70 3a 2f 2f 77 77 77 2e 65 74 68 65 72 65 61 6c 2e 63 6f 6d 2f 64 65 76 65 6c 6f 70 6d 65 6e 74 2e 68 74 6d 6c 0d 0a 0d 0a								

After The packet formation, the packet is sent to Data link layer and Ethernet protocol is used here.



A4.

The IPv4 fields and their relevance are:

Version: The first header field is a 4-bit version indicator. In the case of IPv4, the value of its four bits is set to 0100, which indicates 4 in binary.

Header Length: IHL is the 2nd field of an IPv4 header, and it is of 4 bits in size. This header component is used to show how many 32-bit words are present in the header.

Type of Service: ToS is also called Differentiated Services Code Point. This field is used to provide features related to service quality, such as for Voice over IP (VoIP) calls. It is used to specify how a datagram will be handled.

Total Length: This field's size is 16 bit, and it is used to denote the size of the entire datagram.

Identification: The identification or ID field in a packet can identify an IP datagram's fragments uniquely.

Flags: Flag in an IPv4 header is a three-bit field that is used to control and identify fragments.

Fragment Offset: This field is 13 bit long in length, and it is measured by blocks that are units of 8-byte blocks. These are used to specify the offset of a fragment relative to the start of the IP datagram, which when it was not fragmented.

Time to live: Time to live (or TTL in short) is an 8-bit field to indicate the maximum time the datagram will be live in the internet system.

Protocol: This is a filed in the IPv4 header reserved to denote which protocol is used in the later (data) portion of the datagram.

The header's checksum: The checksum field is of 16-bit length, and it is used to check the header for any errors. The header is compared to the value of its checksum at each hop, and in case the header checksum is not matching, the packet is discarded.

Source Address: It is a 32-bit address of the source of the IPv4 packet.

Destination Address: the destination address is also 32 bit in size, and it contains the receiver's address.

Options: This is an optional field of the IPv4 header. It is used only when the value of IHL is set to more than 5. These options contain values and settings for things related to security, Record route and time stamp etc.

Q5: Find the Ethernet II frame fields for HTTP request and find their relevance [2 marks]

<table>
<tr><td colspan="10">Destination MAC (48 bits): fe:ff:20:00:01:00</td></tr>
<tr><td colspan="10">Source MAC (48 bits): 00:00:01:00:00:00</td></tr>
<tr><td colspan="10">Type/Length : IPv4 0x0800</td></tr>
<tr><td colspan="3">Version:
4</td><td colspan="3">Header Length:
20 bytes (5)</td><td colspan="2">ToS:
0x00</td><td colspan="2">Total Length: 519</td></tr>
<tr><td colspan="8">Identifier: 0x0f45 (3909)</td><td>Flags: 0x40</td><td>Fragment Offset: 0</td></tr>
<tr><td colspan="3">TTL: 128</td><td colspan="5">Protocol: TCP (6)</td><td colspan="2">Header Checksum: 0x9010</td></tr>
<tr><td colspan="10">Source IP Address
145.254.160.237</td></tr>
<tr><td colspan="10">Destination IP Address
65.208.228.223</td></tr>
<tr><td colspan="8">Source Port: 3372</td><td colspan="2">Destination port: 80</td></tr>
<tr><td colspan="10">Sequence Number: 1</td></tr>
<tr><td colspan="10">Acknowledge number: 1</td></tr>
<tr><td>HL:
20 bytes</td><td>RES
000</td><td>URG
0</td><td>ACK
1</td><td>PSH
1</td><td>RST
0</td><td>SYN
0</td><td>FIN
0</td><td colspan="2">Window Size: 9660</td></tr>
</table>

Checksum: 0xa958	**Urgent pointer: 0**
Options:	
Data: 47 45 54 20 2f 64 6f 77 6e 6c 6f 61 64 2e 68 74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 77 77 77 2e 65 74 68 65 72 65 61 6c 2e 63 6f 6d 0d 0a 55 73 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 36 29 20 47 65 63 6b 6f 2f 32 30 30 34 30 31 31 33 0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 68 74 6d 6c 2b 78 6d 6c 2c 74 65 78 74 2f 68 74 6d 6c 3b 71 3d 30 2e 39 2c 74 65 78 74 2f 70 6c 61 69 6e 3b 71 3d 30 2e 38 2c 69 6d 61 67 65 2f 70 6e 67 2c 69 6d 61 67 65 2f 6a 70 65 67 2c 69 6d 61 67 65 2f 67 69 66 3b 71 3d 30 2e 32 2c 2a 2f 2a 3b 71 3d 30 2e 31 0d 0a 41 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a 20 65 6e 2d 75 73 2c 65 6e 3b 71 3d 30 2e 35 0d 0a 41 63 63 65 70 74 2d 45 6e 63 6f 64 69 6e 67 3a 20 67 7a 69 70 2c 64 65 66 6c 61 74 65 0d 0a 41 63 63 65 70 74 2d 43 68 61 72 73 65 74 3a 20 49 53 4f 2d 38 38 35 39 2d 31 2c 75 74 66 2d 38 3b 71 3d 30 2e 37 2c 2a 3b 71 3d 30 2e 37 0d 0a 4b 65 65 70 2d 41 6c 69 76 65 3a 20 33 30 30 0d 0a 43 6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0a 52 65 66 65 72 65 72 3a 20 68 74 74 70 3a 2f 2f 77 77 77 2e 65 74 68 65 72 65 61 6c 2e 63 6f 6d 2f 64 65 76 65 6c 6f 70 6d 65 6e 74 2e 68 74 6d 6c 0d 0a 0d 0a	

A5.

The Ethernet II frame fields for HTTP request has an Ethernet header, which contains the destination and source MAC addresses.

MAC addresses are used to uniquely identify a computer on the LAN. It is an essential component required for network protocols like TCP/IP to function.

The primary importance of source and destination MAC addresses is to identify the physical source and destination devices (NICs) on the local network segment.