Transport Layers

Q1.

Source Port : 56816		Destination Port: 80	
Sequence Number: 1530249478			
Acknowledge Number: 6519812			
DO: 20 bytes	RSV: 0	Flags: 0x010	Window: 2064
Checksum: 0x28d6			Urgent Pointer: 0

- **Source port**: this is a 16 bit field that specifies the port number of the sender.
- **Destination port**: this is a 16 bit field that specifies the port number of the receiver.
- **Sequence number**: the sequence number is a 32 bit field that indicates how much data is sent during the TCP session. When you establish a new TCP connection (3 way handshake) then the initial sequence number is a random 32 bit value. The receiver will use this sequence number and send back an acknowledgment. Protocol analyzers like wireshark will often use a *relative sequence number of 0* since it's easier to read than some high random number.
- **Acknowledgment number**: this 32 bit field is used by the receiver to request the next TCP segment. This value will be the sequence number incremented by 1.
- **DO**: this is the 4 bit data offset field, also known as the header length. It indicates the length of the TCP header so that we know where the actual data begins.
- **RSV**: these are 3 bits for the reserved field. They are unused and are always set to 0.
- **Flags**: there are 9 bits for flags, we also call them control bits. We use them to establish connections, send data and terminate connections:
    - **URG**: urgent pointer. When this bit is set, the data should be treated as priority over other data.
    - **ACK**: used for the acknowledgment.
    - **PSH**: this is the push function. This tells an application that the data should be transmitted immediately and that we don't want to wait to fill the entire TCP segment.
    - **RST**: this resets the connection, when you receive this you have to terminate the connection right away. This is only used when there are unrecoverable errors and it's not a normal way to finish the TCP connection.

    - **SYN**: we use this for the initial three way handshake and it's used to set the initial sequence number.
    - **FIN**: this finish bit is used to end the TCP connection. TCP is full duplex so both parties will have to use the FIN bit to end the connection. This is the normal method for how we end a connection.
- **Window**: the 16 bit window field specifies how many bytes the receiver is willing to receive. It is used so the receiver can tell the sender that it would like to receive more data than what it is currently receiving. It does so by specifying the number of bytes beyond the sequence number in the acknowledgment field.
- **Checksum**: 16 bits are used for a checksum to check if the TCP header is OK or not.
- **Urgent pointe**r: 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.

Q2.

Source Port: 62085	Destination Port: 443
Length: 41	Checksum: 0xce25

1. **Source Port :** Source Port is 2 Byte long field used to identify port number of source.
2. **Destination Port :** It is 2 Byte long field, used to identify the port of the destined packet.
3. **Length :** Length is the length of UDP including header and the data. It is a 16-bits field.
4. **Checksum :** Checksum is 2 Bytes long field. It is the 16-bit one's complement of the one's complement sum of the UDP header, pseudo header of information from the IP header and the data, padded with zero octets at the end (if necessary) to make a multiple of two octets.

Q3.

C0a8
0108
= c1af
4a7d
=0c2d
C1bd
=cdea
0011
=cdfb
0029
=ce24
4bae
=18d3
5292
=6b65
E5b6
=512c
B43d
=056a
F1ce
=f738
E674
=ddad
B712
=94c0
0d85
=a245
B03c
=5282
27f4

=7a76
7f4b
=f9c1
Cbfe
=c5c0
89d1
=4f92
0edd
=5e6f
161e
=748d
A824
=1cb2
0e00
=2ab2

0010 1010 1011 0010

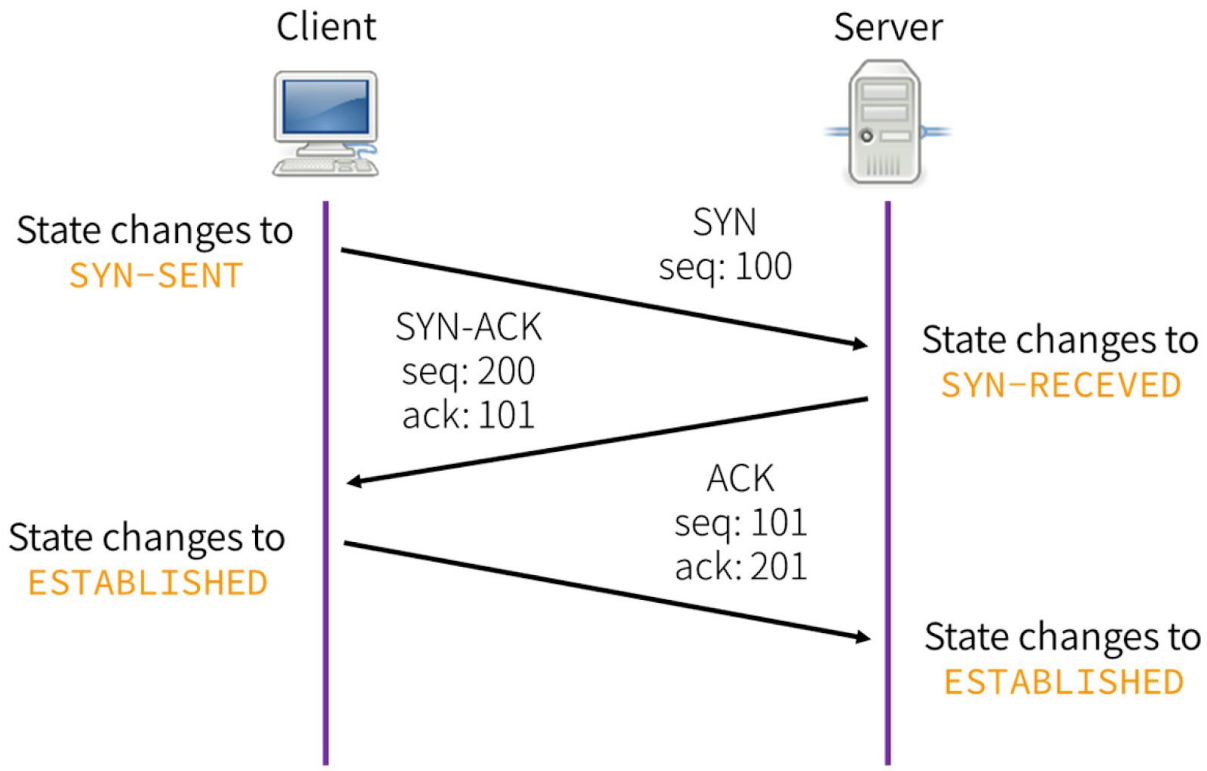
1 compliment = 1101 0101 0100 1101
Hex = d54d

Q4.

Video streaming all use TCP and simply buffer a few seconds of content, instead of using UDP since the delay is not crucial and TCP transfers can be easily accomplished over HTTP and web browsers without the need for additional plugins and software.

Q5

THREE-WAY HANDSHAKE or a TCP 3-way handshake is a process which is used in a TCP/IP network to make a connection between the server and client. It is a three-step process that requires both the client and server to exchange synchronization and acknowledgment packets before the real data communication process starts



Q6

Client ------FIN-----> Server
Client <-----ACK------ Server ----(2)
Client <-----FIN------ Server ----(3)
Client ------ACK-----> Server

In connection Termination : it takes four segments to terminate a connection since a FIN and an ACK are required in each direction.
(2) means that The received FIN (first segment) is acknowledged (ACK) by TCP
(3) means that sometime later the application that received the end-of-file will close its socket. This causes its TCP to send a FIN.
And then the last segment will mean that The TCP on the system that receives this final FIN acknowledges (ACK) the FIN.

Bonus

1. **Explain range of TCP/IP classes**

Answer :
CLASS A = 1 to 126
CLASS B = 128 to 191
CLASS C = 192 to 223
CLASS D = 224 to 239 (Multicasting)
CLASS E = 240 to 255 (Research)

2. **What are Pvt. IP address ?**

Answer : Pvt. IP are IPs which are not used in Internet or which are not routable in
Internet. They are also called non-routable IP's. Class A = 10.0.0.0 to 10.255.255.255
Class B = 172.16.0.0 to 172.31.255.255
Class C = 192.168.0.0. to 192.168.255.255