1. (25 Points) Given that a frame is formatted as follows:

And given that an IP datagram is formatted as follows:

And given that a TCP segment is formatted as follows:

Assuming no options are present in the IP header and TCP header, And given the following frame with an encapsulated IP datagram and TCP segment:
a. Find the source hardware address
b. Find the destination hardware address
c. What type of frame is this?
d. What is the Type Of Service in the IP Header?
e. What is the fragment offset?
f. What is the TTL count?
g. Find the source IP address
h. Find the IP Header Checksum
i. What class is the source IP address?
j. What is the network ID in the source address?
k. What is the host ID in the source address?
l. Write the source IP address in dotted decimal notation.
m. Find the destination IP address
n. What class is the destination IP address?
o. What is the network ID in the destination address?
p. What is the host ID in the destination address?
q. Write the destination IP address in dotted decimal notation.
r. Find the source port.
s. Find the destination port.
t. Find the sequence number.
u. Find the acknowledgment number.
w. What flags are set in the TCP header?
x. Find the TCP segment checksum.
y. What are the first 5 bytes of data encapsulated inside the TCP segment?

2. (25 Points) Each router in the autonomous system shown below starts with a routing table showing the networks that they are directly connected to. The routers exchange routing information using a distance vector protocol. Show the messages that are exchanged and the state of the routing tables after each message. Use the Routing Tables sheet(s).
3. **(20 Points)** Consider a fixed subnet partition of the class B network 128.10.0.0 that will accommodate at least 273 subnets.
   
a. **(4 Points)** How many bits will be necessary to address the 273 subnets?
b. **(4 Points)** What is the subnet mask in dotted decimal notation?
c. **(4 Points)** What is the maximum number of hosts each subnet can have?
d. **(8 Points)** Write the dotted decimal IP address of subnet host 123.

4. **(15 Points)** Given the IP address 152.138.205.123 and the subnet mask of 255.255.252.0, what is the subnet number?
   
a. **(5 Points)** What is the network number?
b. **(5 Points)** What is the subnet number?
c. **(5 Points)** What is the host number?

5. **(10 Points)** Explain fragmentation as it relates to datagrams. Why is it necessary? Where does it occur? When and where are the fragments reassembled? How are the fragments reassembled? Be as specific as possible.

6. **(10 Points)** Explain Network Address Translation (NAT). What is it? Why do we need it? How does it work?

7. **(15 Points)** Explain sliding windows as used by TCP. How does it work? How does it change? Who changes the various components? Why is all this done?