1. True or False (with explanation)

a. Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send Host A. Host B will not send acknowledgments to Host A because Host B cannot piggyback the acknowledgments on data.

False because piggyback is for efficiency not necessity. Host B will send send acknowledgement packets as a response.

b. Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends only depends on the congestion window size and not on the receive window size

True because the congestion window determines how much can be sent to avoid losing packets. Receive window size

c. If a TCP receiver receives 10 packets simultaneously, it will only send one acknowledgement back to the sender, because TCP uses cumulative Acknowledgement.

False because it will still need to send ack for all 10.

d. One of the key reasons for IPv6 to not be popular is the wide adoption of Network Address Translation

True because NATs reduce the number of IPs in use. IPv6 was suppose to go into effect when IPv4 addresses ran low, but now companies that required hundreds of public IP address can just use 1 public IP address, and make the rest private hidden behind the NAT.

e. An intermediate router needs both the destination IP address and its subnet mask to determine how to route a packet to the destination.

True because the network address is found by ANDing the mask and IP address. By knowing the network address the router can then figure out where to send the package.

2. Consider a TCP connection from host A to host B along a route with RTT=50ms. Assume that Host A initiates the connection with Host B and immediately starts to send data to Host B. Host B does not send any data to Host A except acknowledgement. Assume that the slow start threshold is initially 64 packets. Assume the initial congestion window size = 1.

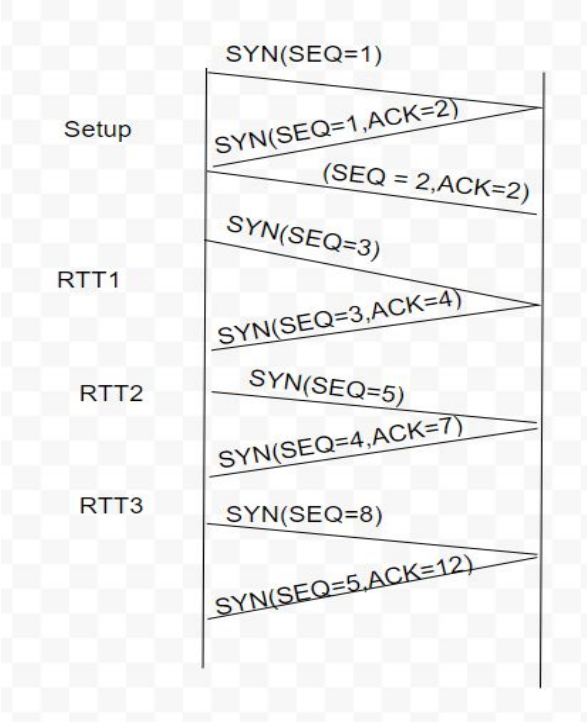
After how much time (in ms) does TCP switch from slow start to congestion avoidance phase assuming that no loss occurs during the slow start phase? Start your calculations from before the TCP set up time. Assume RTT is a constant. Assume that TCP moves out of slow start phase if the congestion window size in the previous RTT is >= slow start threshold.

1(1) 2(2) 3-4(3) 5-8(4) 9-16(5) 17-32(6) 33-64(7)

350ms

3. For the previous question, illustrate the packet transfer between A and B starting from the TCP set up phase and the next three RTTs. Specify the sequence # and ack # for each transfer. Assuming the sequence number starts from 1 on both directions.

Assume all packets are received in order and there is a small gap between the receipt of each packet at B. (i.e., the packets are not received simultaneously)



4.

(i) Explain what abstractions the transport layer provides to the application layer?

It standardizes server to host and peer to peer connection, and data transfers. It uses source and destination addresses.

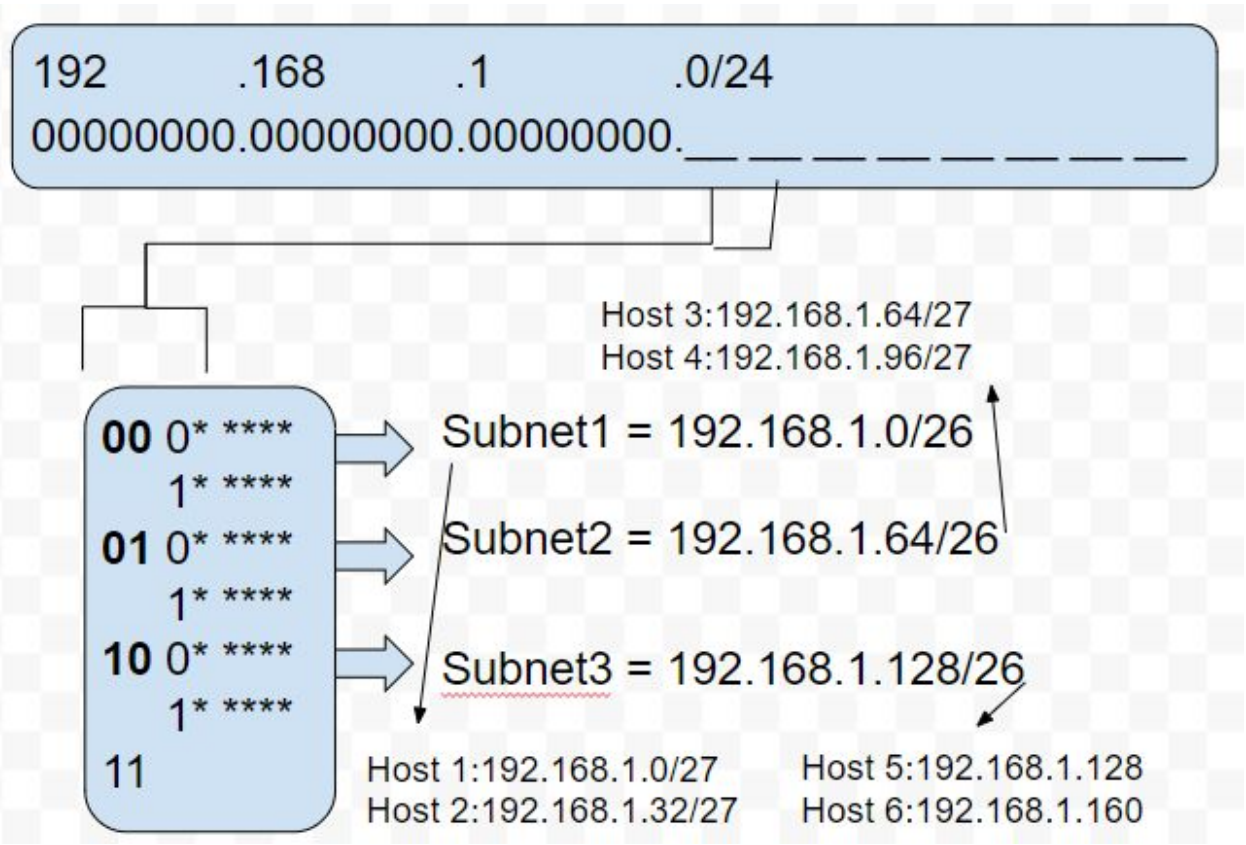
(ii)Explain how TCP provides reliability and in-order delivery.

TCP has acknowledgements sent as a reply so when one isn't it knows to send another packet. This helps prevent packet loss by retransmitting the lost packet. In-order delivery happens because when the packets above the lost packet arrive and the lost doesn't it has everything sent again so if 6,7 and 8 arrive, but 5 doesn't then 5,6,7 and 8 are resent.

(iii) What is the difference between TCP and UDP.

TCP has acknowledgement sent back and UDP doesn't. UDP is generally used when a few lost packets don't matter, and TCP is used when reliability matters.

5. Suppose your ISP gives you the address space 192.168.1.0/24.You want 3 subnets and you want to connect 2 hosts each on each of the subnets. Write down the addresses you will assign to the 6 hosts and to the 3 subnets. Draw the resulting network.


192 .168 .1 .0/24
00000000.00000000.00000000.__ __ __ __ __ __ __ __
Host 3:192.168.1.64/27
Host 4:192.168.1.96/27
00 0* ****
1* ****
01 0* ****
1* ****
10 0* ****
1* ****
11
Subnet1 = 192.168.1.0/26
Subnet2 = 192.168.1.64/26
Subnet3 = 192.168.1.128/26
Host 1:192.168.1.0/27
Host 2:192.168.1.32/27
Host 5:192.168.1.128
Host 6:192.168.1.160