1. Consider the network in Figure 1, this network is misconfigured. Host A is configured with IP: 10.10.10.2/16 – MAC address: MAC_A. Host B is configured with 10.10.10.5/24 — MAC address: MAC_B. Router R1 has two interfaces 1 and 2 with MAC addresses: R1_1 and R1_2 respectively. Router R3 has two interfaces 1 and 2 with MAC addresses: R3_1 and R3_2 respectively.

Given this configuration, answer the questions below.

(a) The switching tables are empty. A wants to send a packet to B. Does A perform an ARP-request?
(b) If A performs an ARP-request. What are the MAC addresses on the ARP-request packet.
   
   SRC MAC: 
   DST MAC:
   
(c) If A performs an ARP-request, who responds?
(d) When A sends the packet to B, what are the MAC addresses on the packet when A creates the packet?
   
   SRC MAC: 
   DST MAC:
   
(e) Does the Packet reach B?

   If the packet reaches B, what are the MAC addresses on the packet when it reaches B?
   
   SRC MAC: 
   DST MAC:
2. Consider the Wide Area Network in figure 2.

(a) ISP-X has two customers: ISP-Z, ISP-W. If ISP-Z requires 250 addresses and ISP-W requires 124 addresses. What is the smallest prefix that ISP-Z can assign to each customer.

CIDR Prefix assigned to ISP-W:
CIDR Prefix assigned to ISP-Z:

(a) How many distinct route advertisements will ISP-X receive from ISP-Z, ISP-W, and ISP-A?

ISP-Z:
ISP-W:
ISP-A:

(b) What is ISP-B’s forwarding table?

(c) What are the Stub ASes in this figure?
(d) What are the MultiHomed ASes in this figure?

(a) which of these paths is a valid path?

- \( E \rightarrow C \rightarrow B \rightarrow A \rightarrow X \rightarrow W \)
- \( E \rightarrow C \rightarrow D \rightarrow B \rightarrow A \rightarrow X \rightarrow W \)
- \( F \rightarrow D \rightarrow E \)
- \( F \rightarrow D \rightarrow C \rightarrow E \)

3. Consider a TCP New Reno connection. The last ACK received by the sender has the ACK number 1000. The packet are each 1000B large – you can imagine that all packets are 1000B. The receiver window size is always 5000 and the advertised window is always 4000. The initial sequence number is 0. Recall, TCP uses cumulative ACKs. Recall TCP New Reno includes Fast Retransmit and Fast Recovery.

Figure 3: TCP Congestion Window (CWND) over time.

If the receiver gets packets with the following sequence numbers (in the following order), what does the receiver do? (a) Send an ACK, (b) Drop the packet, (c) Save the packet. Select one of the three, if the receiver sends an ACK – please specify the ACK number.

- The receiver receives a packet with sequence num 1000?
- The receiver receives a packet with sequence num 3000?
- The receiver receives a packet with sequence num 4000?
- The receiver receives a packet with sequence num 5000?
- The receiver receives a packet with sequence num 6000?
• The receiver receives a packet with sequence num 2000?

4. Consider the TCP Timeline in Figure 3:

• During which RTTs do Timeouts occur?
• During which RTTs do FastRecovery/FastRetransmit occur?
• What is the initial SSThresh value?
• What is the SSThresh value at RTT 20?
• At RTT 15, is TCP in Slow Start or in AIMD?

5. TCP Reno uses congestion control and TCP Vegas uses congestion avoidance to determine the appropriate window size and sending rate. Both algorithms attempt to estimate the current window based on signals from the network, how do they differ?

6. What is the approximate throughput for a connection if the buffer is 1/2 bandwidth delay product?