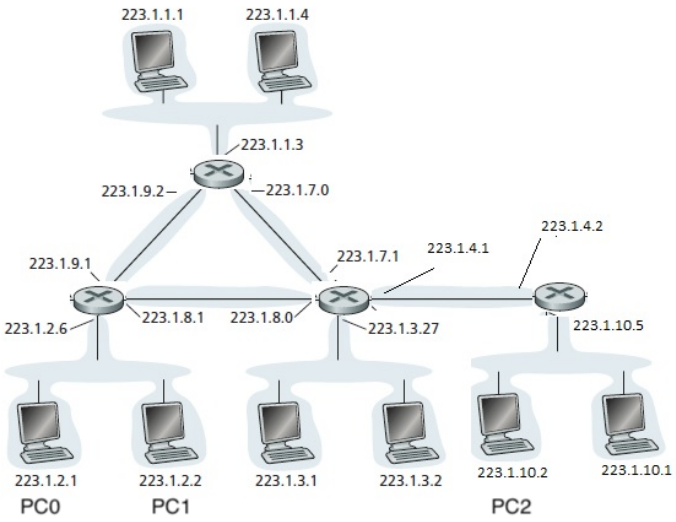
Problem 1

Consider the network shown below.



(a) How many subnets are in this network?

(b) What information in DHCP will be exchanged if PC0 moves to PC2's network?

Write your solution to Problem 1 in this box

a) 8 subnets

b) DHCP is triggered

- new IP allocated for PC0 in line w/ IP for that subnet.

ex: 223.1.10.3

(PC0 may broadcast DHCP discover message to find DHCP server.

server responds DHCP offer. → host can request/receive IP.)

Problem 2

Consider sending a 2400 B datagram into a link that has an MTU (maximum transmission unit) of 800 B. Suppose the original datagram is stamped with the identification number 422.

(a) How many fragments are generated?

(b) What are the values in the various fields in the IP datagram(s) generated related to fragmentation?

Write your solution to Problem 2 in this box

a) 4 frags generated

$\frac{2400-20}{800-24} \times 3.06 \rightarrow 4$ frags needed

24 = 20 + 4 ← data in bytes
↳ IP header

20 → IP header

b)

	length	ID	frag flag	offset
1st frag	796	422	1	0
2nd frag.	796	422	1	776/8 = 97
3rd frag	796	422	1	2·776/8 = 194
4th frag.	72	422	0	3·776/8 = 291

Problem 3

In this problem we will explore the impact of NATs on P2P applications. Suppose a peer with username Arnold discovers through querying that a peer with username Bernard has a file it wants to download. Also suppose that Bernard and Arnold are both behind a NAT. Try to devise a technique that will allow Arnold to establish a TCP connection with Bernard without application-specific NAT configuration. If you have difficulty devising such a technique, discuss why.

Write your solution to Problem 3 in this box

Impossible to devise such a technique without NAT config b/c to establish a connection

1) host include TCP connection to other

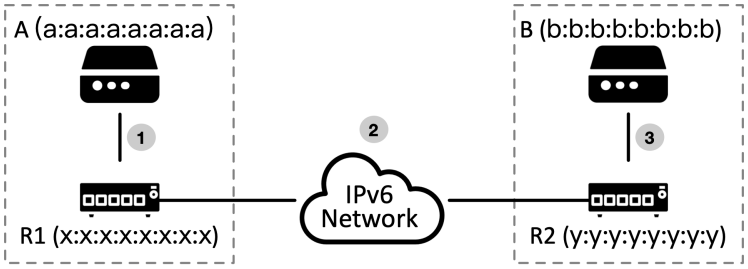
↓

both hosts behind NAT

NAT will drop SYN packets coming from WAN side

Problem 4

Assume there are two hosts on a private network communicating with **IP tunneling**. The private IP addresses of host A and B are a:a:a:a:a:a:a:a and b:b:b:b:b:b:b:b, respectively. They are connected with two routers R1 and R2 with public IP addresses x:x:x:x:x:x:x:x and y:y:y:y:y:y:y:y, respectively. Now A initiates a TCP connection to B with a TCP SYN segment, which goes through the positions (1), (2) and (3) as shown in the figure.



(a) What are the source and destination IP addresses for this packet in position (1)?

(b) What are the source and destination IP addresses for this packet in position (2)?

(c) What are the source and destination IP addresses for this packet in position (3)?

Write your solution to Problem 4 in this box

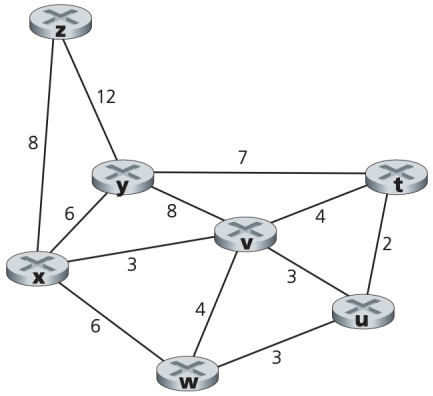
a) source: a:a:a:a:a:a:a:a
dest: y:y:y:y:y:y:y:y

b) source: x:x:x:x:x:x:x:x
dest: y:y:y:y:y:y:y:y

c) source: x:x:x:x:x:x:x:x
dest: b:b:b:b:b:b:b:b

Problem 5

Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes.



Write your solution to Problem 5 in this box

x → z : take direct path x→z cost: 8

x → y : direct path x→y cost: 6

x to v : " " x→v cost 3

x to w : " " x→w cost 6

x to t : x→v, v→t 3+4 = 7

x to u : x→v, v→u 3+3 = 6