1. The following two IP addresses and associated network prefixes, refer to two hosts attached to different campus networks that have each been subnetted to allow for 5 distinct subnets to be configured on each campus. (10pts.)
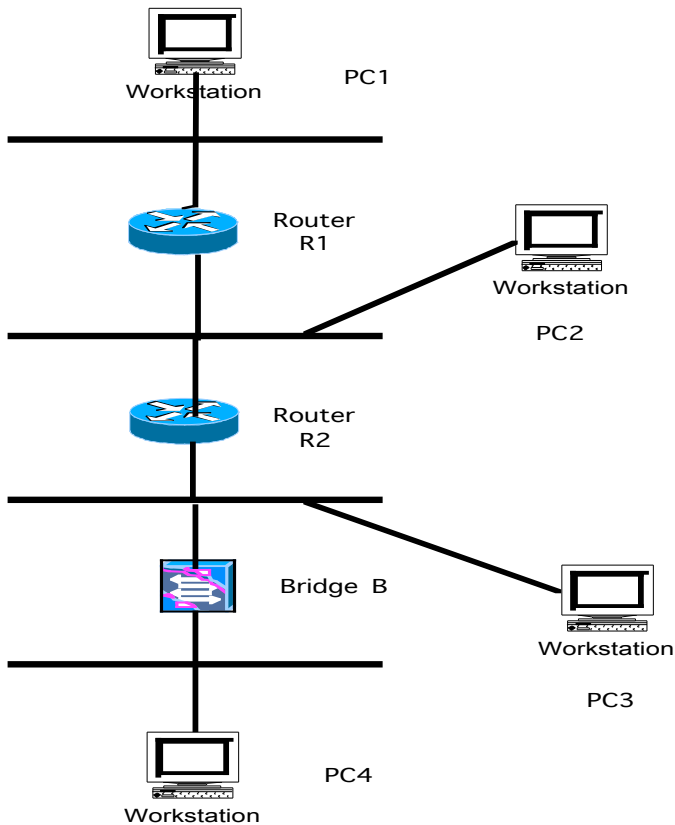
- 128.36.199.3/19
- 200.3.7.54/28

For <u>each</u> one of these two IP addresses, identify:

    i   The network ID
    ii   The subnet mask
    iii The campus network ID
    iv The host ID
    v   The local broadcast address

Use the table below for your responses:

	128.36.199.3/19	200.3.7.54/28
Local Network ID		
Subnet Mask		
Campus Network ID		
Host ID		
Broadcast Address		

2. Given the following network configuration: (22pts.)

Four PCs are connected to 4 LANs (one PC per LAN). One bridge and 2 routers are used to interconnect the 4 LANs. The campus network address is: 165.143.0.0/16

    a. Assign an IP address to each network interface. Assume that the upper interface is numbered "eth0/0" and the lower interface is numbered "eth0/1" for the 2 routers and the bridge.(5pts.)

PC1:

PC2:

PC3:

PC4:

R1_0:

R1_1:

R2_0:

R2_1:

B_0:

B_1:

Assume that the network uses static routing.

b. Give the routing table for each host. Ignore the loopback and the multicast entries but include any appropriate flags and explain the meaning of each. (4pts)

c. On a Linux PC, what command is used to add a route to a network destination address via a gateway? Illustrate with an example. (1pt.)

d. Show the source and destination physical/MAC addresses for a frame carrying an IP address as it is traversing the 3 Ethernets from host PC4 to host PC2. For your answer use the following notation: MAC_R1_1 for physical/MAC interface eth0/1 on R1, IP_R1_1 for IP address of interface eth0/1 on R1, etc. (1.5pts.)

e. Show the entries in the bridge B forwarding table after several pings have been exchanged between all 4 PCs. (4.5pts)

f. If router R2 is replaced with a bridge, B2, what changes would have to be made to the routing tables of the PCs so that they can continue communicating with each other. Give the forwarding table of bridge B2 after several pings have been exchanged between all 4 PCs. Will you see a change in the entries of the forwarding table of bridge B (after any invalid entries existent in table have expired)? Explain your answer. (6pts.)

3.   Suppose we have the RIP forwarding tables shown below for routing nodes *A* and *F*, in a network where all links have cost 1. Give a diagram of the smallest network consistent with these tables. (6pts)

Node A			Node F		
node	cost	next hop	node	cost	next hop
B	1	B	A	3	E
C	2	B	B	2	C
D	1	D	C	1	C
E	2	B	D	2	E
F	3	D	E	1	E

4. A client and a server establish a TELNET session and the client types in a character "r". Fill in the blanks representing the fields in the packets transmitted between the client and the server from time to establish the session to sending the character "r". Use "*" to indicate empty entries. The * in the table below represents an empty field. (4pts)

Direction	Sequence Number	ACK number	Flags Set	Length	Payload
Client->server	4592367891	*	SYN	0	*
Server->client	8814357119				
Client->server			ACK		
Client->server		*	*	1	r
Server->client					
Client->server			ACK	0	*

5. Given the following routing table on a particular host: (4pts.)
```
% netstat -rn
Destination      Gateway     Genmask          Flags  Iface
10.0.96.100      10.0.160.1  255.255.255.255  UGH    eth0
10.0.32.0        10.0.160.2  255.255.224.0    UG     eth0
10.0.96.0        10.0.160.3  255.255.224.0    UG     eth0
10.0.192.0       10.0.160.4  255.255.224.0    UG     eth0
10.0.160.0       *           255.255.224.0    U      eth0
127.0.0.0        *           255.0.0.0        U      lo
0.0.0.0(default) 10.0.160.5  0.0.0.0          UG     eth0
```

If you type the following commands:

a) % ping 10.0.96.100
Where would this ping packet be forwarded to? Explain why.

b) % ping 10.0.197.101
Where would this ping packet be forwarded to? Explain why.

 6. If a 3000 byte IP datagram, carrying a TCP segment, is sent over a data link that has an MTU of 500 bytes: (4pts.)

a) How many fragments will be generated?

b) How many bytes of overhead will each fragment have (assume no options in the headers)?

c) If the original IP datagram is stamped with ID 0x433, what will be the ID of each subsequent fragment?

d) How many ACKs will TCP send? Why?