Numerical Problems from Network Layer

1. Consider the subnet shown in Fig. 1. Distance vector routing is used, and the following vectors have just come in to router C: from B: (5,0,8,12,6,2); from D: (16,12,6,0,9,10); and from E: (7,6,3,9,0,4). The measured delays to B, D and E are 6, 3 and 5, respectively. What is C's new routing table? Give both the outgoing line to use and the expected delay.

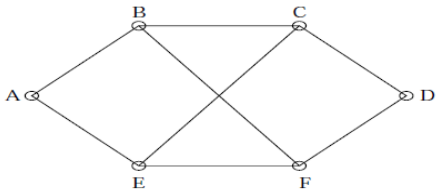

Fig. 1: Subnet

2. A large number of consecutive IP addresses are available starting at 198.16.0.0. Suppose that four organizations, A, B, C, and D, request 4000, 2000, 4000, and 8000 addresses, respectively, and in that order. For each of these, give the ¯rst IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation.

3. For the following IP addresses (i) determine the class of each IP address, (ii) indicate the network and host ids for each IP address. (1) 198.45.72.231, (2) 227.83.56.42, (3) 184.66.92.133 and (4) 111.211.224.23.

4. A network consists of 2,56,000 hosts has organized into subnets at 3 levels. At level-1, all 2,56,000 hosts are connected, at level-2 hosts are divided into four groups and at level-3 each group at level-2 is further divided into four subgroups. Assume the partitions at level-2 and level-3 are performed uniformly. Indicate the first and last address of groups and subgroups at each level. Derive the network masks at each level for routing the packets to the desired destinations. The required IP address space is provided by the ISP starting from 132.96.0.0

5. Derive the complete IPv6 address from the following abbreviated form: C::B0F:0:FF, and (ii) Obtain the most optimal abbreviated form for the following IPv6 address:00AB:0000:0000:0000:2200:0000:0000:DE00

6. For the subnet shown in Fig-2 (Fig. 5.6 (a) in Tanenbaum 4 ed.) , draw the spanning tree and the tree for reverse path forwarding for broadcast routing. The source node for broadcasting is I. Analyze the efficiency of above trees in terms of number of packets generated and the number of hops needed to perform broadcasting. If flooding with maximum hop count of 3 is chosen for broadcasting, what will be performance in comparison with the above trees?

7. Compute a multicast spanning tree for router H in the following subnet shown in Fig.2, for a group with members at routers D, A, F, G, L, O, N, J and M.

8. Assume that you have 256 host address space is available at 202.224.154.0. Suppose that four groups A, B, C, and D, request 100, 55, 30 and 20 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation.

9. Mention different header fields in IPv4. Assume a 2000 byte data packet (packet id: 10) has to pass through two networks whose MTUs are 600 and 400 bytes respectively, to reach destination. Specify the IP fields related to fragmentation in the case of transparent and non-transparent fragmentations (i) at the source, (ii) while passing through the network whose MTU is 600 (iii) while passing through the network whose MTU is 400 and (iv) at the destination. How the destination IP combine these fragments and regenerate the original packet?

10. Suppose six departments of an institute A, B, C, D, E and F need 87, 52, 31, 13, 7 and 5 IP addresses. A class-C network address 202.25.45.0 has been allotted to the institute. Suggest the appropriate subnetting scheme and derive the appropriate subnet marks for each department. Also provide the starting and ending address of each department.

11. Show the forwarding process of the following packets at the router R1 with the following destination addresses:
(a) 180.70.65.140 (b) 201.4.22.35 (c) 18.24.32.78

Routing Table for Router R1			
Mask	Network Address	Next Hop	Interface
255.255.255.192	180.70.65.192	-------	m2
255.255.255.128	180.70.65.128	--------	m0
255.255.255.0	201.4.22.0	--------	m3
255.255.252.0	201.4.16.0	--------	m1
Any	Any	180.70.65.200	m2

12. In an IPv4 datagram, the M-bit is zero, the value of HLEN is five, the value of total length is 200 and the offset value is 200. (a) What is the number of the first byte and the number of the last byte in this datagram? (b) Is this the last or first or middel fragment?

13. Suppose five departments of an institute A, B, C, D and E need 110, 45, 28, 14 and 12 IP addresses. A class-C network address 198.131.172.0 has been allotted to the institute. Suggest the appropriate subnetting scheme and derive the appropriate subnet marks for each department. Also provide the starting and ending address of each department.
14. A router has the following (CIDR) entries in its routing table:

Address/Mask	Next hop
135.46.56.0/22	Interface 0
135.46.60.0/22	Interface 1
192.53.40.0/23	Router 1
default	Router 2

For each of the following IP addresses, what does the router do if a packet with that address arrives?