



**COMSATS Institute of Information Technology, Lahore**  
**Department of Computer Science**

**Course:** Advanced Topics in Computer Networks  
**Instructor:** Rab Nawaz Khan Jadoon  
**Exam:** Final Term  
**Semester:** Fall 2010

**Class:** MS-CS  
**Max Marks:** 50  
**Time:** 3Hrs  
**Date:** 17-02-2011

**Special instructions:**

1. First of all write down your name and registration# clearly on your question paper as well as answer paper.
2. You must write Question Paper Serial# in the circle at top left side of title page of your Answer-book.
3. While answering your questions, you must indicate on your Answer-book the same question No. as appears in your question paper.
4. Candidates are required to give their answers in their own words as far as practicable. Marks allotted to each question are indicated against it.
5. All the sections are compulsory.
6. If any helping material is found during the exam, the student is directly punished according to the CIIT rules.

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**(Solution Manual)**

**Question 1:**

**(10)**

- a) **A block of addresses is granted to a small organization. We know that one of the addresses is 205.16.37.39/28. What is the (the first address, the last address, and total number of addresses in the block?)**

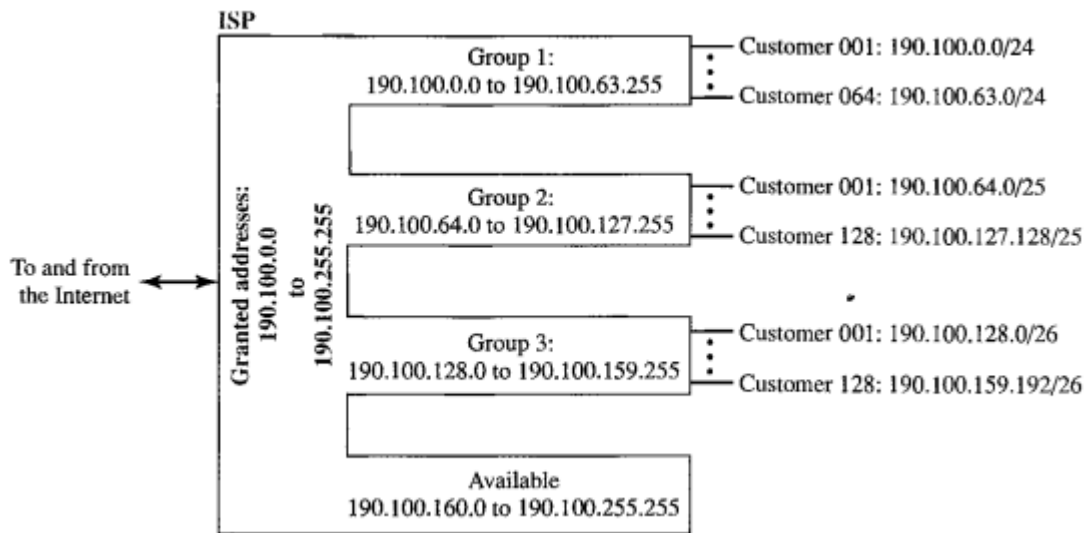
**Solution:**

1. The first address in the block can be found by setting the rightmost 32- n bits to Os.  
OR  
a. The first address can be found by ANDing the given addresses with the mask.
2. The last address in the block can be found by setting the rightmost 32 - n bits to Is.  
OR  
a. The last address can be found by ORing the given addresses with the complement of the mask.
3. The number of addresses in the block can be found by using the formula  $2^{32-n}$ .  
OR  
a. The number of addresses can be found by complementing the mask, interpreting it as a decimal number, and adding 1 to it.

b) An ISP is granted a block of addresses starting with 190.100.0.0/16 (65,536 addresses). The ISP needs to distribute these addresses to three groups of customers as follows:

- 1) The first group has 64 customers; each needs 256 addresses.
- 2) The second group has 128 customers; each needs 128 addresses.
- 3) The third group has 128 customers; each needs 64 addresses.
- 4) Design the subblocks and find out how many addresses are still available after these allocations.

**Solution:**



## 1. Group 1

For this group, each customer needs 256 addresses. This means that 8 ( $\log_2 256$ ) bits are needed to define each host. The prefix length is then  $32 - 8 = 24$ . The addresses are

1st Customer: 190.100.0.0/24      190.100.0.255/24

2nd Customer: 190.100.1.0/24      190.100.1.255/24

.....

64th Customer: 190.100.63.0/24      190.100.63.255/24

Total =  $64 \times 256 = 16,384$

## 2. Group 2

For this group, each customer needs 128 addresses. This means that 7 ( $\log_2 128$ ) bits are needed to define each host. The prefix length is then  $32 - 7 = 25$ . The addresses are,

1st Customer: 190.100.64.0/25      190.100.64.127/25

2nd Customer: 190.100.64.128/25      190.100.64.255/25

.....

128th Customer: 190.100.127.128/25                      190.100.127.255/25 3.

Total =  $128 \times 128 = 16,384$

### 3. Group 3

For this group, each customer needs 64 addresses. This means that 6 ( $\log_2 64$ ) bits are needed to each host. The prefix length is then  $32 - 6 = 26$ . The addresses are,

1st Customer: 190.100.128.0/26

2nd Customer: 190.100.128.64/26

.....

128th Customer: 190.100.159.192/26

Total =  $128 \times 64 = 8192$

Number of granted addresses to the ISP: 65,536

Number of allocated addresses by the ISP: 40,960

Number of available addresses: 24,576

#### **Question 2:** (10)

- a. Contrast TDMA with CDMA in terms of advantages regarding medium access?**

##### **Solution:**

##### **TDMA**

In time-division multiple access (TDMA), the stations share the bandwidth of the channel in time. Each station is allocated a time slot during which it can send data. Each station transmits its data in its assigned time slot. In TDMA, the bandwidth is just one channel that is timeshared between different stations.

##### **CDMA**

Code-division multiple access (CDMA) was conceived several decades ago. Recent Advances in electronic technology have finally made its implementation possible. CDMA differs from FDMA because only one channel occupies the entire bandwidth of the link. It differs from TDMA because all stations can send data simultaneously; there is no timesharing.

**b. How Chipping sequences are created in CDMA?**

**Solution**

To generate chip sequences, we use a Walsh table, which is a two-dimensional table with an equal number of rows and columns, as shown in Figure,

$$W_1 = \begin{bmatrix} +1 \end{bmatrix} \quad W_{2N} = \begin{bmatrix} W_N & W_N \\ W_N & \overline{W_N} \end{bmatrix}$$

a. Two basic rules

$$W_1 = \begin{bmatrix} +1 \end{bmatrix} \quad W_2 = \begin{bmatrix} +1 & +1 \\ +1 & -1 \end{bmatrix} \quad W_4 = \begin{bmatrix} +1 & +1 & +1 & +1 \\ +1 & -1 & +1 & -1 \\ +1 & +1 & -1 & -1 \\ +1 & -1 & -1 & +1 \end{bmatrix}$$

b. Generation of  $W_1$ ,  $W_2$ , and  $W_4$

**c. Find the chips for a network with,**

**a. Two stations**

**b. Four stations**

**Solution**

a. For a two-station network, we have  $[+1 \ +1]$  and  $[+1 \ -1]$ .

b. For a four-station network we have  $[+1 \ +1 \ +1 \ +1]$ ,  $[+1 \ -1 \ +1 \ -1]$ ,  $[+1 \ +1 \ -1 \ -1]$ , and  $[+1 \ -1 \ -1 \ +1]$ .

**d. What is the number of sequences if we have 90 stations in our network?**

**Solution:**

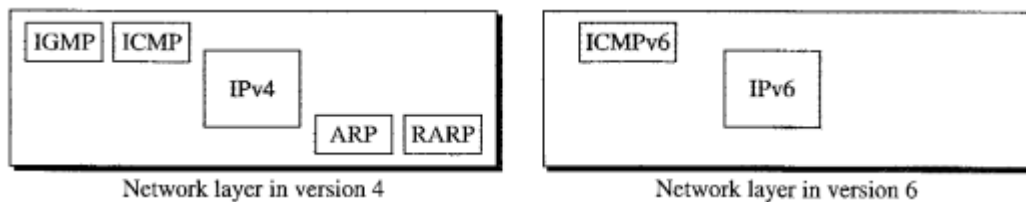
The number of sequences needs to be  $2^m$ . We need to choose  $m = 7$  and  $N = 2^7$  or 128. We can then use 90 of the sequences as the chips.

**Question 3:**

(10)

**a. Discuss the difference between ICMPv4 and ICMPv6?**

**Solution:**



The ARP and IGMP protocols in version 4 are combined in ICMPv6. The RARP

Protocol is dropped from the suite because it was rarely used and BOOTP has the same functionality.

**b. Discuss the following error reporting messages in ICMP,**

- a. Type 3
- b. Type 4
- c. Type 5

**Solution:**

**Type 3 (Destination Unreachable)**

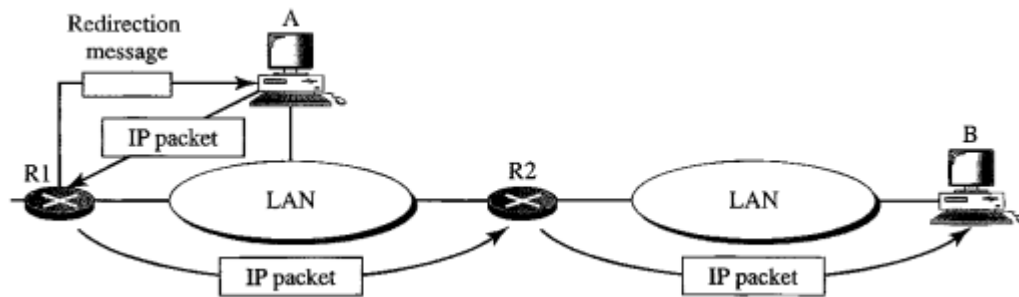
When a router cannot route a datagram or a host cannot deliver a datagram, the datagram is discarded and the router or the host sends a destination-unreachable message back to the source host that initiated the datagram.

**Type 4 (Source Quench)**

The source-quench message in ICMP was designed to add a kind of flow control to the IP. When a router or host discards a datagram due to congestion, it sends a source-quench message to the sender of the datagram. This message has two purposes. First, it informs the source that the datagram has been discarded.

**Second**, it warns the source that there is congestion somewhere in the path and that the Source should slow down (quench) the sending process.

**Type 5 (Redirection)**



**c. Discuss the basic operation of IGMP? In IGMP, a membership report is sent twice, one after the other, why?**

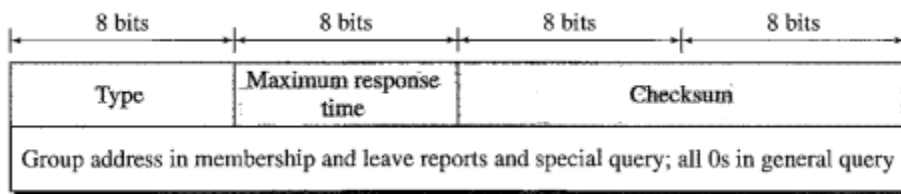
**Solution:**

IGMP is not a multicasting routing protocol; it is a protocol that manages group membership. In any network, there are one or more multicast routers that distribute Multicast packets to hosts or other routers. The IGMP protocol gives the multicast routers information about the membership status of hosts (routers) connected to the network.

**Operation:**

IGMP operates locally. A multicast router connected to a network has a list of multicast addresses of the groups with at least one loyal member in that network.

For each group, there is one router that has the duty of distributing the multicast packets destined for that group. This means that if there are three multicast routers connected to a network, their lists of groupids are mutually exclusive. A host or multicast router can have membership in a group. When a host has membership, it means that one of its processes (an application program) receives multicast packets from some group. When a router has membership, it means that a network connected to one of its other interfaces receives these multicast packets. We say that the host or the router has an interest in the group. In both cases, the host and the router keep a list of groupids and relay their interest to the distributing router

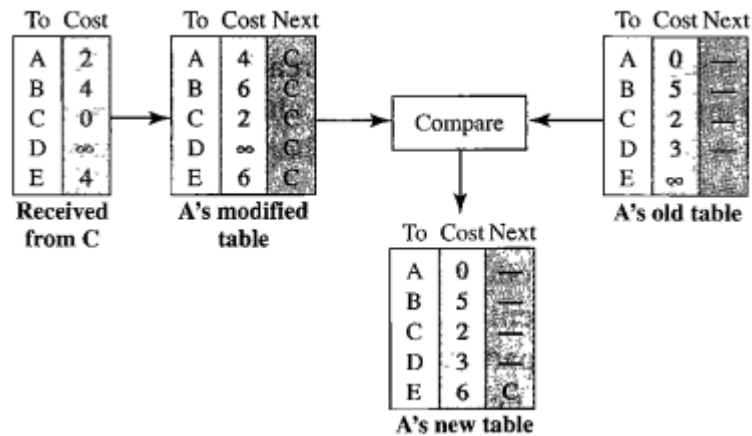
**d. Discuss the IGMP message format?****Solution:****Question 4:****(10)****a. How routing tables are updated in Distance vector routing?****Solution:**

When a node receives a two-column table from a neighbor, it needs to update its routing table. Updating takes three steps:

1. The receiving node needs to add the cost between itself and the sending node to each value in the second column. The logic is clear. If node C claims that its distance to a destination is  $x$  mi, and the distance between A and C is  $y$  mi, then the distance between A and that destination, via C, is  $x + y$  mi.
2. The receiving node needs to add the name of the sending node to each row as the third column if the receiving node uses information from any row. The sending node is the next node in the route.
3. The receiving node needs to compare each row of its old table with the corresponding row of the modified version of the received table.

- a. If the next-node entry is different, the receiving node chooses the row with the smaller cost. If there is a tie, the old one is kept.
  - b. If the next-node entry is the same, the receiving node chooses the new row.
- For example, suppose node C has previously advertised a route to node X with distance

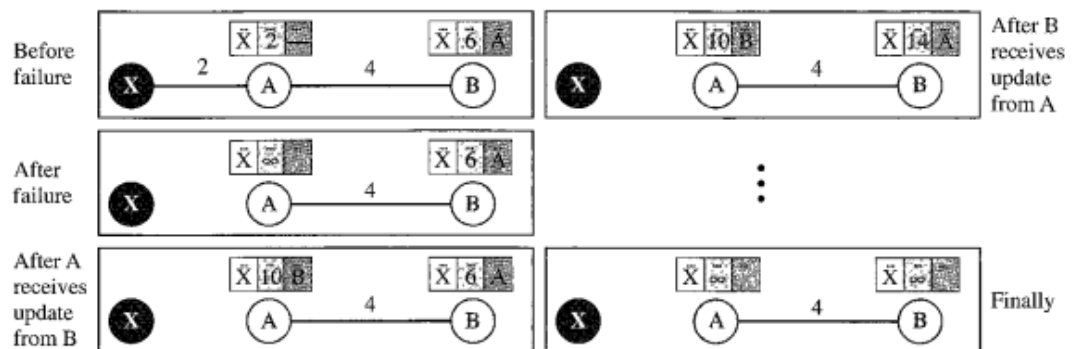
4. Suppose that now there is no path between C and X; node C now advertises this route with a distance of infinity. Node A must not ignore this value even though its old entry is smaller. The old route does not exist any more. The new route has a distance of infinity.



**b. What is the “two node loop instability” in DVR? What different strategies are advised be researcher to solve this problem?**

**Solution:**

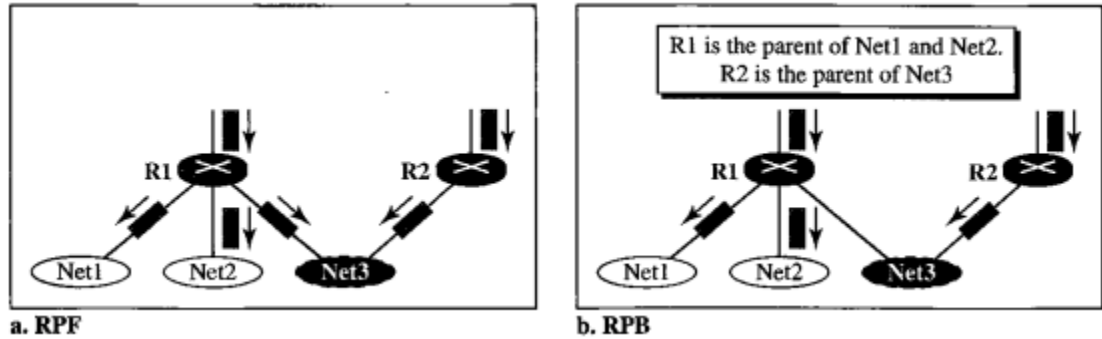
A problem with distance vector routing is instability, which means that a network using this protocol can become unstable.



Following are some well known strategies use to overcome the above problem,

- i. Defining infinity
- ii. Split Horizon
- iii. Split horizon with reverse poison

**c. Pictorially represents the difference between RPF and RPB?**

**Solution:**

### Question 5:

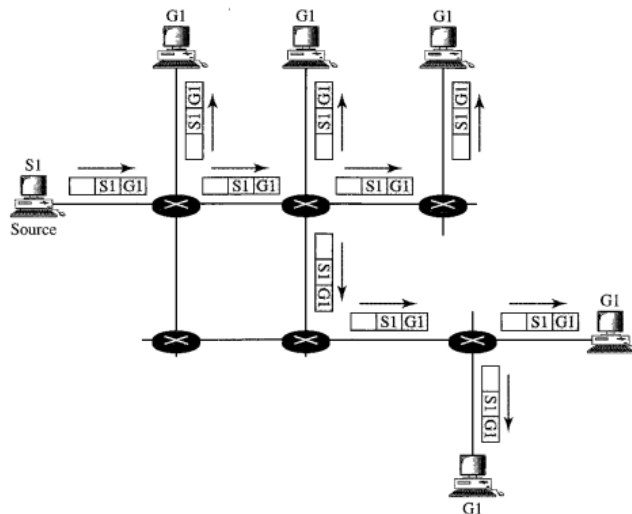
**(10)**

**a. What is multicasting and multiple unicasting?**

**Solution:**

## Multicasting

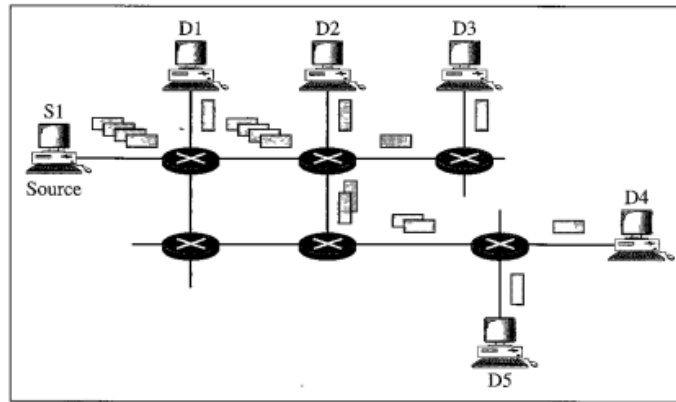
In multicast communication, there is one source and a group of destinations. The relationship is one-to-many. In this type of communication, the source address is a unicast address, but the destination address is a group address, which defines one or more destinations. The group address identifies the members of the group.



## Multiple Unicasting

In multiple unicasting, several packets start from the source. If there are five destinations, for example, the source sends five packets, each with a different unicast destination address.





b. Multiple unicast routing

**b. What is source based tree? Discuss its major bottleneck?**

**Solution:**

### **Source Based Tree**

In the source-based tree approach, each router needs to have one shortest path tree for each group. The shortest path tree for a group defines the next hop for each network that has loyal member(s) for that group.

### **Bottleneck**

We can imagine the complexity of the routing table if we have hundreds or thousands of groups. However, we will show how different protocols manage to alleviate the situation.

**c. Briefly discuss the core of your research paper that you have done?**

**Solution:**

This is answered by students

\*\*\*Best of Luck\*\*\*