Fall 2024, CS 3953: Computer Networks

Homework 4

Problem 1 (15 points)

Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows: (20 points)

Destination Address Range	Link interface
10010000 00000000 00000000 00000000 Through 10010000 01111111 11111111 11111111	0
10010000 10000000 00000000 00000000 Through 10010000 10111111 11111111 11111111	1
10010000 11000000 00000000 00000000 Through 10010000 11111111 11111111 11111111	2
Otherwise	3

1. Provide a forwarding table that has five entries, uses longest prefix matching, and forwards packets to the correct link interfaces. (5 points)
2. Rewrite this forwarding table using the a.b.c.d/x notation instead of the binary string notation. (5 points)
3. Describe how your forwarding table determines the appropriate link interface for data grams with destination addresses: (5 points)

10010000 01010101 00001111 10101010
10010000 10010001 11100011 00010010
10010100 00000000 11111111 00000000

Problem 2 (20 points)

1. Assign network addresses to each of these six subnets, with the following constraints:
   All addresses must be allocated from 192.168.16.0/23; (10 points)
   Subnet A should have enough addresses to support 250 interfaces;
   Subnet B should have enough addresses to support120 interfaces;
   Subnet C should have enough addresses to support 120 interfaces.
   Subnets D, E and F should each be able to support two interfaces.
   For each subnet, the assignment should take the form a.b.c.d/x or a.b.c.d/x – e.f.g.h/y.

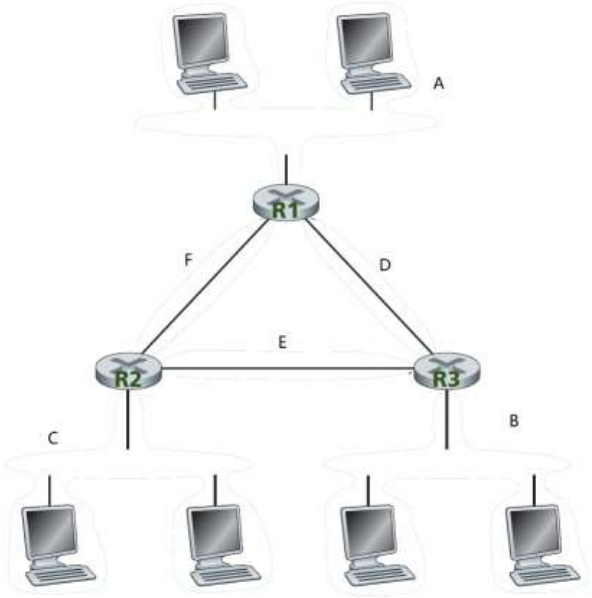

Figure1: The topology in Problem 2

2. Using your answer to part 1, provide the forwarding tables (using longest prefix matching) for each of the three routers. To simplify the solution, assume that no datagrams have router interfaces as ultimate destinations, and use subnets as the outgoing interfaces. (10 points)

Problem 3 (15 points)
Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node z. (20 points)

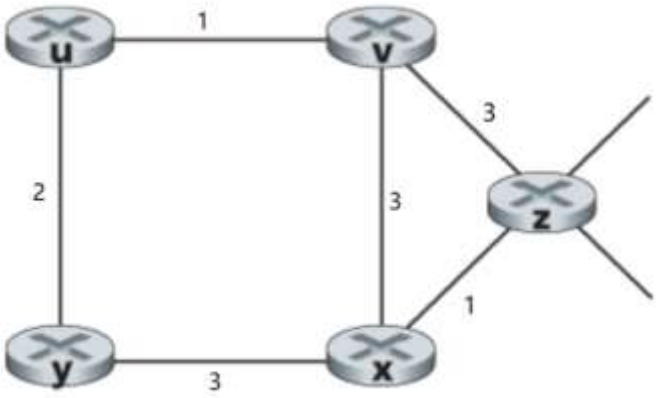

Figure2: The network in Problem 3

Problem 4 (10 points)
What is the difference between Intra-AS Routing and Inter-AS Routing?

Problem 5 (10 points)
Please explain methods to reduce the size of routing table.

Problem 6 (10 points)

Please explain why we need IPv6 to replace IPv4.

Problem 7 (20 points)

Company A needs 1024 IP addresses from an ISP who owns network prefix 206.0.64.0/18.

Company A has 4 departments:

Department1 requires 510 addresses which is further divided into 4 LANs (LAN1-LAN4);

Department2 requires 256 addresses which is further divided into 4 LANs (LAN5-LAN8);

Department3 requires 128 addresses which is further divided into 2 LANs (LAN9-LAN10);

Department4 requires 128 addresses which is further divided into 2 LANs (LAN11-LAN12).

Another subnet LAN0 only needs 1 public IP address which uses NAT.

Please assign IP prefixes to these 13 subnets with CIDR (Classless Inter Domain Routing) technology. Please fill in the routing tables for RA, R1 and R3.

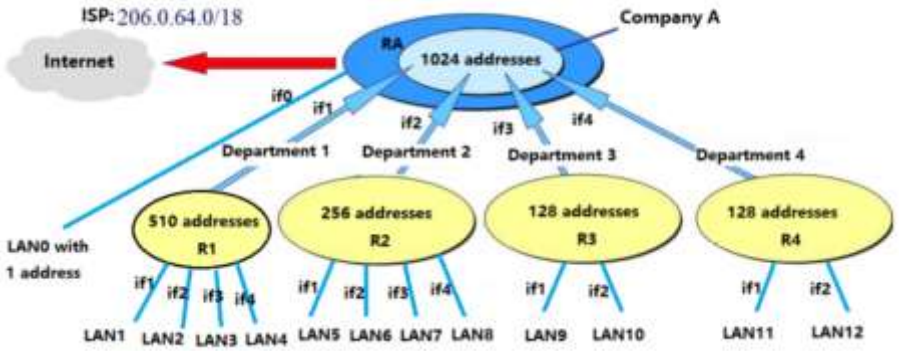

Figure3: The network in Problem 7

network	network prefix	Network mask	network	network prefix	network prefix
LAN0			LAN7		
LAN1			LAN8		
LAN2			LAN9		
LAN3			LAN10		
LAN4			LAN11		
LAN5			LAN12		
LAN6					

RA		
Prefix	**Mask**	**Interface**

R1		
Prefix	**Mask**	**Interface**

R3		
Prefix	**Mask**	**Interface**