Solutions – Week4

Q1) The only entries in a certain route table are (128.59.28.0/22, port 0), (128.59.28.0/23, port 1) and (128.59.28.0/24, port 2). These entries indicate CIDR network number, the prefix and the corresponding port to which a packet should be forwarded. If a packet arrives with a destination IP address equal to 128.59.29.18, which port will this router forward the packet to?

Answer: The address of the IP packet matches 128.59.28.0 in the first 23 bits. The 24th bit is different. Since we use the longest prefix match, the router will use the port corresponding to 128.59.28.0/23 in its route table, and forward the packet to port 1.

Q2. A Router R1 has received a datagram with destination IP = 199.20.30.30. The current routing table at R1 has got four entries as follows:

199.20.30.0/28	Interface 1
199.20.30.16/29	Interface 2
199.20.30.24/30	Interface 3
Default	Interface 4

Which interface would be selected by R1 to forward this packet? Show your working.

Answer: Network ranges
199.20.20.0/28 to 199.20.20.15/28
199.20.20.16/29 to 199.20.20.23/29
199.20.20.24/30 to 199.20.20.27/30

R1 would forward to interface 4.

Q3. Suppose an ISP owns the block of addresses of the form 101.101.128/17. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?

Answer: Four equal size subnets, borrow 2 bits, mask becomes 19, host bits remaining 13, each subnet can have 8192 IPs, 8192/256=32

101.101.128/19, 101.101.160/19, 101.101.192/19, 101.101.224/19.

Q4. Suppose a peer with user name Arnold discovers through querying that a peer with user name Bernard has a file it wants to download. Also suppose that Bernard is behind a NAT whereas Arnold isn't. Let 138.76.29.7 be the WAN-side address of the NAT and let 10.0.0.1 be the internal IP address for Bernard. Assume that the NAT is not specifically configured for the P2P application.

(a) Discuss why Arnold's peer cannot initiate a TCP connection to Bernard's peer, even if Arnold knows the WAN-side address of the NAT, 138.76.29.7.

Answer: NAT will not have an entry for a connection initiated from the WAN side, hence will drop incoming packets from Arnold.

(b) Now, suppose that Bernard has established an ongoing TCP connection to another peer, Cindy who is not behind a NAT. Also suppose that Arnold learned from Cindy that Bernard has the desired file and that Arnold can establish (or already has established) a TCP connection with Cindy. Describe how Arnold can use these two TCP connections (one from Bernard to Cindy and the other from Arnold to Cindy) to instruct Bernard to initiate a direct TCP connection (that is, not passing through Cindy) back to Arnold. This technique is sometimes called connection reversal. Note that even though Bernard is behind a NAT, Arnold can use this direct TCP connection to request the file, and Bernard can use the connection to deliver the file.

Answer: Bernard can know the IP address of Arnold through Cindy. Then, the p2p application can initiate a connection through NAT to Arnold and upload the file.

Q5. Suppose you purchase a wireless router/ADSL modem and connect it to your telephone socket. Also suppose that your ISP dynamically assigns one IP address to your connecting device (i.e. your router/modem). Also suppose that you have five PCs at home that use 802.11 to wirelessly connect to your wireless router. How are IP addresses assigned to five PCs? Does the wireless router use NAT? Why or why not?

Answer: Typically, the wireless router includes a DHCP server. DHCP is used to assign IP addresses to the 5 PCs and to the router interface. Yes, the wireless router also uses NAT as it obtains only one IP address from the ISP.

Q6. List all the changes a NAPT box makes in TCP and IP headers when it receives a packet from inside node (private IP address) destined to a global IP address say 8.8.8.8.

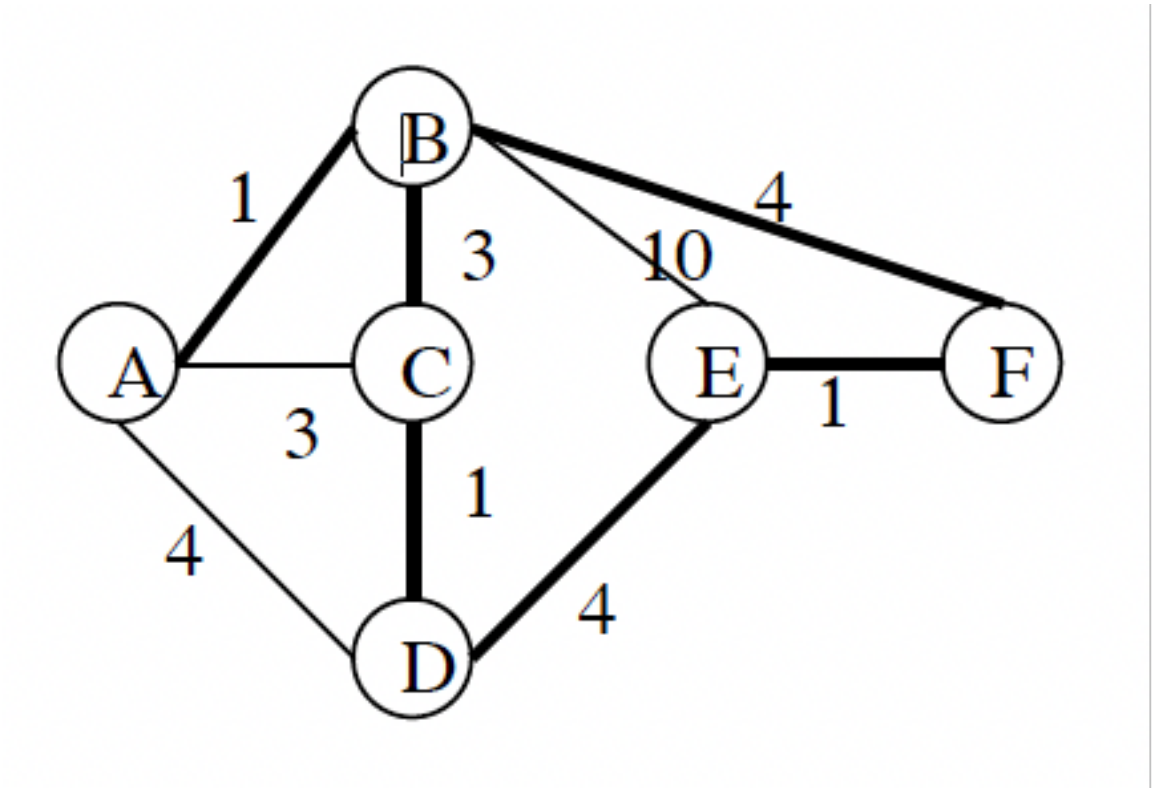
The changes the following fields in IP header: Source IP address and IP header Checksum

In TCP Header: Source Port No and TCP Checksum

Q7.

(a) The shortest path routes from F to all the destinations have been shown as thick

lines in Figure 1 in the question. The operation of Dijkstra's algorithm is shown in the following table:



Step	*N*	*D(A), p(A)*	*D(B), p(B)*	*D(C), p(C)*	*D(D), p(D)*	*D(E), p(E)*
0	*F*	∞	*4,F*	∞	∞	*1.F*
1	*FE*	∞	*4.F*	∞	*5,E*	
2	*FEB*	*5,B*		*7,B*	*5,E*	
3	*FEBD*	*5,B*		*6,D*		
4	*FEBDA*			*6,D*		
5	*FEBDAC*					

(b) The destination table in B is shown below:

Cost to				
A	**C**	**D**	**E**	**F**
1	3	4	5	4

Q8. Consider the network shown in Figure 2 and assume that each node initially knows the costs to each of its neighbours. Consider the distance vector algorithm and show the distance table entries at node z.

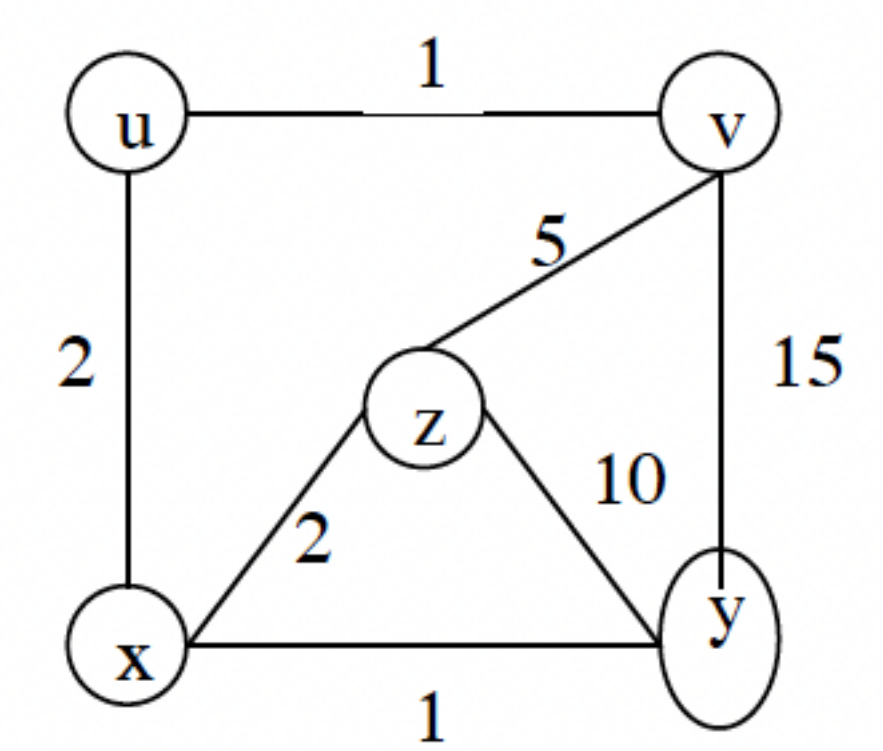


Figure 2 Network topology for Q8

Answer: The distance table in z is:

To	Via			
		V	X	Y
	U	6	4	13
	V	5	5	14
	X	8	2	11
	Y	9	3	10