

CISC7002 Computer Networks

Homework 2 Solutions

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Question 1 (a) The binary form of the MAC address of 1A-2F-BB-76-09-AD is: 0001 1010 – 0010 1111 – 1011 1011 – 0111 0110 – 0000 1001 – 1010 1101

(b) The special meaning of the MAC address of FF-FF-FF-FF-FF-FF is: **broadcast address**. The frame is received by every device on a LAN.

(c) The differences between the MAC address and IP address are:

1. MAC address is 48-bit. IP address is 32-bit.
2. MAC address is used in Data Link Layer. IP address is used in Network layer.
3. MAC address is unique and permanent address in every host such as data link interface, network interface card, NIC. It is assigned by manufacturer. IP address is assigned according the Network Topology. Private IP Address can be identical in different LAN.

(d) The source/destination IP addresses will **not** change.

(e) The source/destination MAC addresses **will** change.

Question 2 (a) ARP is address resolution protocol. It is used for discovering the link layer address, such as a MAC address.

(b)

1. A broadcasts ARP query packet, containing B's IP address: destination MAC address=FF-FF-FF-FF-FF-FF. All nodes on LAN receive ARP query.
2. B receives ARP packet, replies to A with B's MAC address: frame sent to A's MAC address (unicast).
3. A saves IP-to-MAC address pair in its ARP table until information becomes old (times out).

Question 3 (a)

Step	N'	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	u	2,u	5,u	1,u	∞	∞
1	ux	2,u	4,x		2,x	∞
2	uxy	2,u	3,y			4,y
3	uxyv		3,y			4,y
4	uxyvw					4,y
5	uxyvwz					

(b)

Step	N'	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(u), p(u)
0	z	∞	5,z	∞	2,z	∞
1	zy	∞	3,y	3,y		∞
2	zyx	5,x	3,y			4,x
3	zyxw	5,x				4,x
4	zyxwu	5,x				
5	zyxwuv					

Question 4 (a)

node x table		cost to		
		x	y	z
	from x	0	4	30
	from y	∞	∞	∞
	from z	∞	∞	∞

		cost to		
		x	y	z
from x	x	0	4	6
from y	y	4	0	2
from z	z	30	2	0

		cost to		
		x	y	z
from x	x	0	4	6
from y	y	4	0	2
from z	z	6	2	0

node y table		cost to		
		x	y	z
	from x	∞	∞	∞
	from y	4	0	2
	from z	∞	∞	∞

		cost to		
		x	y	z
from x	x	0	4	30
from y	y	4	0	2
from z	z	30	2	0

		cost to		
		x	y	z
from x	x	0	4	6
from y	y	4	0	2
from z	z	6	2	0

node z table		cost to		
		x	y	z
	from x	∞	∞	∞
	from y	∞	∞	∞
	from z	30	2	0

		cost to		
		x	y	z
from x	x	0	4	30
from y	y	4	0	2
from z	z	6	2	0

		cost to		
		x	y	z
from x	x	0	4	6
from y	y	4	0	2
from z	z	6	2	0

(b) The distance vector based algorithm will **not** converge quickly after this increased link cost. Because some characteristics of the DV based algorithm:

1. Each node only has **local** information. They do **not** have global information.
2. **Bad news travels slow.** Because the node only has local information, when the link cost increased, node *x* is misleading. Node *x* only knows the minimum distance is 6 before the link cost increased. Now Node *x* thinks the minimum distance is $6 + 2 = 8 < 60$. However, it is impossible, because it will go through node *y*.

Question 5 (a) Router 3b only performs Intra-AS routing algorithm. Because router 3b is not the gateway router. Gateway routers (3a, 1c, 1b, 2a) need to perform both the Inter-AS routing algorithm and Intra-AS routing algorithm simultaneously. All the routers in the same AS know which routers are gateway routers. All the routers in the same AS perform the same intra-AS routing algorithm.

(b) Intra-AS routing algorithm: OSPF

1. OSPF uses link-state algorithm.
2. Router floods OSPF link-state advertisements to all other routers in entire AS
3. Hierarchical OSPF has two-level hierarchy. It has area border routers, backbone routers and boundary routers.

Inter-AS routing algorithm: BGP

1. BGP provides each AS a means to eBGP and iBGP.
2. It determines "good" routes to other networks based on reachability information and policy
3. BGP uses BGP session to let BGP routers exchange BGP messages.