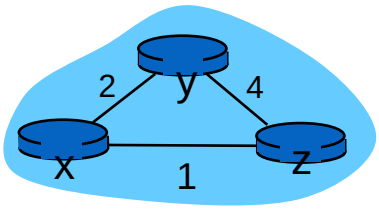
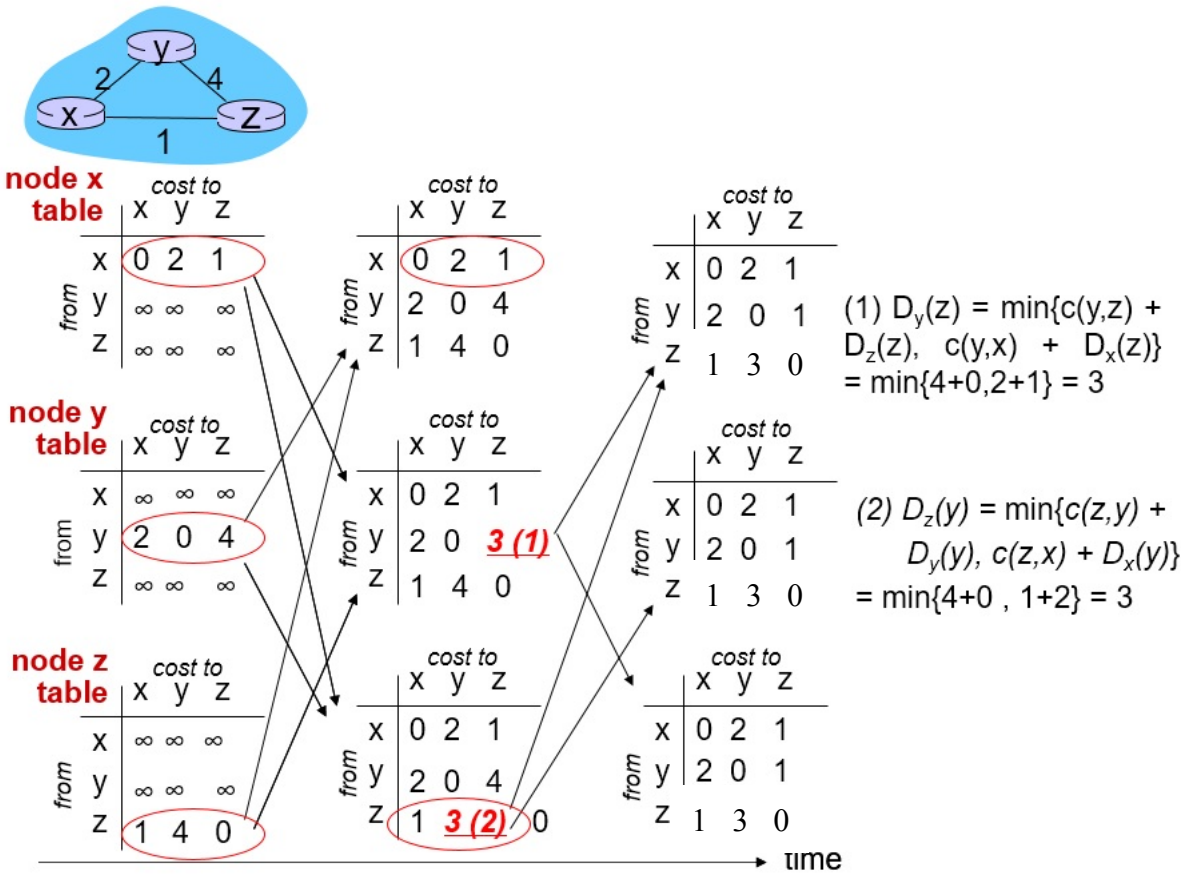
Computer Networks midterm (106/4)

只寫答案而沒有解釋說明，扣一半分數

1. List three tables of node X, Y and Z with the distance vector algorithm, from the time when three nodes are initialized to the time three tables are stabilized. (table 一行 3% (x, y, z 各看自己那列 1%),共 9%。數值有變動時，要寫出公式 2%，一次交換的箭頭 1%, 共 6% => 15% total)



Ans:



2. Use Dijkstra's shortest-path algorithm to compute the shortest path from the source node to all other network nodes. (a) Show how the algorithm works by computing a table. (10%) (b) Show the forwarding table of the source node. (5%) (note: the source node 選法：學號最後一位除以 5 的餘數：0=>v, 1=>z, 2=>y, 3=>x, 4=>w, cost 數值相同時，優先選字母順序較前者; 數值有變動時，要寫出公式) (15% total)

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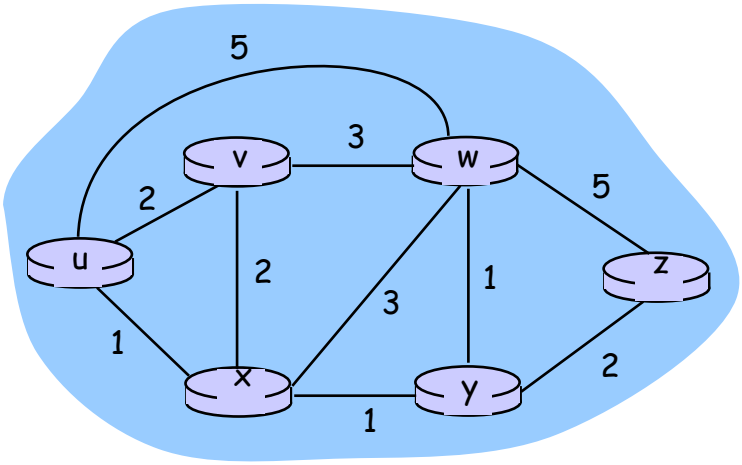

Ans: (除 step 之外，一欄 1 分)

以 v 為起點

Step	N'	D(u), p(u)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	v	2, v	3, v	2, v	∞	∞
1	vu		3, v	2, v	∞	∞
2	vux		3, v		3, x #1	∞
3	vuxw				3, x	8, w #2
4	vuxwy					5, y #3
5	vuxwyz					

#1.D(y)=min(D(y),D(x)+c(x,y))=min(∞, 2+1)=3
#2.D(z)=min(D(z),D(w)+c(w,z))=min(∞, 3+5)=8
#3.D(z)=min(D(z),D(y)+c(y,z))=min(∞, 3+2)=5

Forwarding table （一列 1 分）

Destination	Next hop (output link)
u	u
w	w
x	x
y	x
z	x

以 w 為起點

Step	N'	D(u), p(u)	D(v), p(v)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	w	5, w	3, w	3, w	1, w	5, w
1	wy	5, w	3, w	2, y #1		3, y #2
2	wyx	3, x #3	3, w			3, y
3	wyxu		3, w			3, y
4	wyxuv					3, y
5	wyxuvz					

#1.D(x)=min(D(x),D(y)+c(y,x))=min(3, 1+1)=2
#2.D(z)=min(D(z),D(y)+c(y,z))=min(5, 1+2)=3

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#3.D(u)=min(D(u),D(x)+c(x,u))=min(5, 2+1)=3

Forwarding table

Destination	Next hop (output link)
u	y
v	v
x	y
y	y
z	y

以 x 為起點

Step	N'	D(u), p(u)	D(v), p(v)	D(w), p(w)	D(y), p(y)	D(z), p(z)
0	x	1, x	2, x	3, x	1, x	∞
1	xu		2, x	3, x	1, x	∞
2	xuy		2, x	2, y #1		3, y #2
3	xuyv			2, y		3, y
4	xuyvw					3, y
5	xuyvwz					

#1.D(w)=min(D(w),D(y)+c(y,w))=min(3, 1+1)=2
#2.D(z)=min(D(z),D(y)+c(y,z))=min(∞, 1+2)=3

Forwarding table

Destination	Next hop (output link)
u	u
v	v
w	y
y	y
z	y

以 y 為起點

Step	N'	D(u), p(u)	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(z), p(z)
0	y	∞	∞	1, y	1, y	2, y
1	yw	6, w #1	4, w #2		1, y	2, y
2	ywx	2, x #3	3, x #4			2, y
3	ywxu		3, x			2, y
4	ywxuz		3, x			
5	ywxuzv					

#1.D(u)=min(D(u),D(w)+c(w,u))=min(∞, 1+5)=6
#2.D(v)=min(D(v),D(w)+c(w,v))=min(∞, 1+3)=4
#3.D(u)=min(D(u),D(x)+c(x,u))=min(∞, 1+1)=2
#4.D(v)=min(D(v),D(x)+c(x,v))=min(∞, 1+2)=3

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Forwarding table

Destination	Next hop (output link)
u	x
v	x
w	w
x	x
z	z

以 z 為起點

Step	N'	D(u), p(u)	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)
0	z	∞	∞	5, z	∞	2, z
1	zy	∞	∞	3, y #1	3, y #2	
2	zyw	8, w #3	6, w #4		3, y	
3	zywx	4, x #5	5, x #6			
4	zywxu		5, x			
5	zywxuv					

#1.D(w)=min(D(w),D(y)+c(y,w))=min(5, 2+1)=3
#2.D(x)=min(D(x),D(y)+c(y,x))=min(∞, 2+1)=3
#3.D(u)=min(D(u),D(w)+c(w,u))=min(∞, 3+5)=8
#4.D(v)=min(D(v),D(w)+c(w,v))=min(∞, 3+3)=6
#5.D(u)=min(D(u),D(x)+c(x,u))=min(∞, 3+1)=4
#6.D(v)=min(D(v),D(x)+c(x,v))=min(∞, 3+2)=5

Forwarding table

Destination	Next hop (output link)
u	y
v	y
w	y
x	y
y	y

3. 針對 IPv4 Class C 網路（以十進位表示，要寫完整過程） (26%)
   a. 求出第一個 Class C 網路的網路表示法為何？(2%) 可用 IP 範圍？ (4%) 共有幾個 IP 可用？(2%) mask 的值為何？(2%)
   b. 將第一個 Class C 網路分成 31 個 subnet，subnet mask 的值為何？(2%) 請列出第一個 subnet 的網路表示法 (2%) 可用 IP 範圍？(4%) 共有幾個 IP 可用？(2%)
   c.手動設定電腦的網路時，設定 default gateway 的 IP 有什麼用處？如何使用？(6%)

Ans:

a.

第一個 class C 的 Network ID 表示為 11000000. 00000000. 00000001. XXXXXXXX，十進位為為 192.0.1.0 (2%)

所有 8 個 bit 的 X 不可以全為 0 或 1，

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因此第一個可用 Host ID 為 11000000. 00000000. 00000001.00000001 = 192.0.1.1 (2%)
最後一個可用 Host ID 為 11000000. 00000000. 00000001.11111110 = 192.0.1.254 (2%)
->共有 2^8-2=254 個可用 Host ID (2%)
Mask: 255.255.255.0 (2%)

b.

將第一個 Class C 網路分成 31 個 subnet，加上全為 0 與全為 1 的兩個不能用的 subnet ID，最少需要 31+2=33 subnet mask 的值 => 需要 Host ID 的前 6 個 bits 當作 subnet ID。所以新的 subnet mask 是由原本 Class C 的 default subnet mask 255.255.255.0 來改，改成 11111111. 11111111. 11111111.11111100 => 255.255.255.252 (2%)

subnet 的 ID 要從第一個 Class C Network ID 11000000. 00000000. 00000001.00000000 來改，需要 Host ID 的前 6 個 bits 當作 subnet ID，不可全為 0 或 1。因此第一個 subnet ID 為 11000000. 00000000. 00000001.00000100 => 192.0.1.4 (2%)
因此第一個可用 Host ID 為 11000000. 00000000. 00000001. 00000101 = 192.0.1.5 (2%)
最後一個可用 Host ID 為 11000000. 00000000. 00000001. 00000110 = 192.0.1.6 (2%)
->共有 2^2-2=2 個可用 Host ID (2%)

c. source IP address AND subnet mask 得到 source IP address 所屬的 IP subnet, (1%)
destination IP address AND subnet mask 得到 destination IP address 所屬的 IP subnet, (1%)
if (兩者相同) then
    利用第二層，packet 送到 destination IP address (2%)
else
    利用第二層，packet 送到 default gateway (2%)

4. Consider sending a 2580-byte datagram into a link that has an MTU of 900bytes, including 20-byte IP header. Suppose the original datagram is stamped with the identification number 1. List these segments in a table with their data lengths, IDs, flags and offsets. (表格中 data length, offset 每列 1 分，ID, flag 全部一分。沒有解釋或不清楚，視狀況扣分，8%)

fragment	data lengths	ID	offset	flag
1				
…..				

Ans:

IP data=900–20=880Bytes. 900 Bytes 內 IP data=880Bytes, 2580 byte-20 byte datagram IP data=2560Bytes,分為 880, 880, 800 共 3 個 fragments, 加上 20bytes IP header 後，data length 為 900, 900, 820.

fragment	data lengths	ID	offset	flag
1st	900	1	0	1
2nd	900	1	880/8=110	1
3rd	820	1	110*2=220	0

(data length, offset,每列 1 分，flag、ID 全部一分。沒有解釋或不清楚，視狀況扣分，8%)

5. (a) What is the Intra-AS routing protocol? (2%) What is the Inter-AS routing protocol? (2%)
(b) List two Intra-AS routing standards. (4%) (8% total)

Ans:

(a) routers in same AS run same "intra-AS" routing protocol (2%);
routers in different AS can run different inter-AS routing protocol

(b) **Intra-AS routing protocols: RIP, OSPF (4%)**

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6. Compare and contrast the advertisements used by RIP and OSPF. (8%).

Ans:

- With OSPF,
  - a router periodically broadcasts routing information to all other routers in the AS, not just to its neighboring routers. (2%)
  - This routing information sent by a router has one entry for each of the router's neighbors; the entry gives the distance from the router to the neighbor. (2%)
- A RIP advertisement sent by a router
  - contains information about all the networks in the AS, (2%)
  - although this information is only sent to its neighboring routers. (2%)

7. (a) List four parts of a router. (8%) (b) What is HOL blocking? (4%) (12% total)

Ans:

(a) Input port, Switching fabrics, Output ports, routing processor (2% each)

(b) a queued packet in an input queue must wait (2%) for transfer through the fabric because it is blocked by another packet at the head of the line. (2%)

8. (a) What are two parts of the network prefix? (4%) (b) What is the Classless InterDomain Routing (CIDR)? (2%) How to express its address format? (2%) (8% total)

Ans: (a)prefix: class bit (2%)+Network ID (2%)，表示所屬於的 IP 子網路;

(b) subnet portion of address of arbitrary length (2%) a.b.c.d/x, where x is # bits in subnet portion of address (2%)