Computer Networks midterm (102/4)

只寫答案而沒有解釋說明，扣一半分數

1. Draw a figure to explain how to tunnel IPv6 datagrams between two IPv4 routers? (8%,要說明過程)

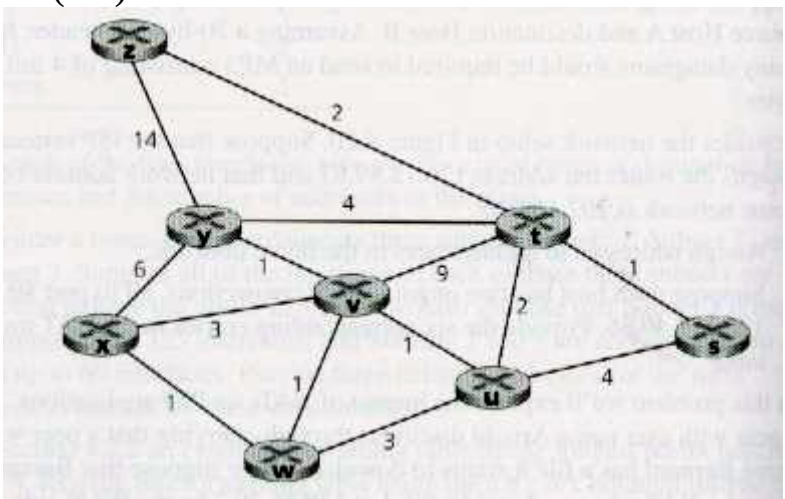
2. What are two main functions of ICMP to communicate network-level information by hosts & routers? (8%)

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

4. (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%)

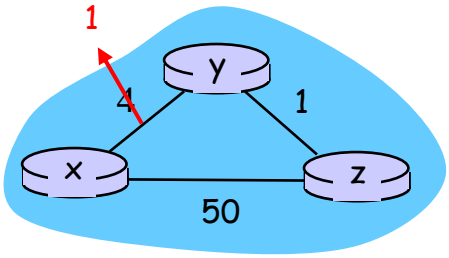
5. 針對 IPv4 Class C 網路（以十進位表示，要寫完整過程） (23%)
   a. 求出第一個 Class C 網路的網路表示法為何？(2%) 可用 IP 範圍？ (4%) 共有幾個 IP 可用？(2%) mask 的值為何？(2%)
   b. 將第一個 Class C 網路分成 7 subnets，subnet mask 的值為何？(2%) 請列出第 7 個 subnet 的網路表示法 (2%) 可用 IP 範圍？(4%) 共有幾個 IP 可用？(2%)
   c.手動設定電腦的網路時，至少要設定哪三個項目的資訊，才可以上網？(3%)

6. Use Dijkstra's shortest-path algorithm to compute the shortest path from w to all network nodes. (a) Show how the algorithm works by computing a table. (數值相同時，優先選字母順序較前者, 公式 1% each, 表格每列(含箭頭)1%, 14% total) (b) show the forwarding table of w. (7%)



7. List changing processes of three tables of node X, Y and Z with the

distance vector algorithm, from the time before the X-Y link cost is changed from 4 to 1 to the time three tables are stabilized. (4 行 table 一行 3%,共 12%， 2 行箭頭各 1%,共 2% => total 14%)



8. Consider sending a 3500-byte datagram into a link that has an MTU of 1500 bytes, 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, flag 每列一分，ID 全部一分。沒有解釋或不清楚，視狀況扣分，10%)

fragment	data lengths	ID	offset	flag
1				
…..				

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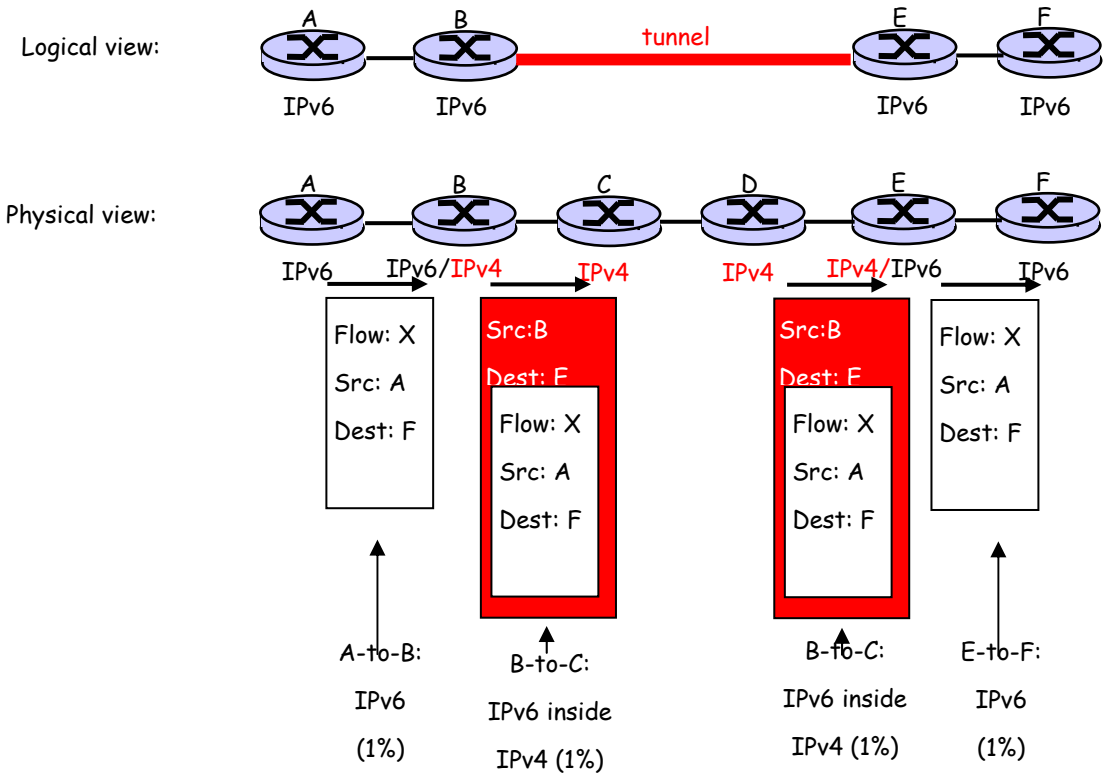
只寫答案而沒有解釋說明，扣一半分數

1. Draw a figure to explain how to tunnel IPv6 datagrams between two IPv4 routers? (8%,要說明過程)

Ans:



- the source IPv4 router encapsulates the new IPv4 datagram by including the original IPv6 datagram as its payload and IPv4 addresses of the two IPv4 routers as the new source and destination IP addresses in the new IPv4 header. (2%)
- the new IPv4 datagram is decapsulated in the destination IPv4 router and the original IPv6 datagram is further transmitted through IPv6. (2%)

2. What are two main functions of ICMP to communicate network-level information by hosts & routers? (8%)

Ans:

- error reporting: unreachable host, network, port, protocol (4%)
- echo request/reply (used by ping) (4%)

3. 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%)

4. (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%)

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%)

5. 針對 IPv4 Class C 網路（以十進位表示，要寫完整過程） (23%)
   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 7 subnets，subnet mask 的值為何？(2%) 請列出第 7 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，至少要設定哪三個項目的資訊，才可以上網？(3%)

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，
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 7 個 subnet，加上全為 0 與全為 1 的兩個不能用的 subnet ID，最少需要 7+2=9 < 2^4, subnet mask 的值 => 需要 Host ID 的前 4 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 255.255.255.11110000 => 255.255.255.240 (2%)

subnet 的 ID 要從第一個 Class C Network ID 11000000. 00000000. 00000001.XXXXXXXX 來改，需要 Host ID 的前 4 個 bits 當作 subnet ID，不可全為 0 或 1。因此第 7 個 subnet ID 為 11000000. 00000000. 00000001.01110000 => 192.0.1.112(2%)
因此第一個可用 Host ID 為 11000000. 00000000. 00000001. 01110001 = 192.0.1.113 (2%)
最後一個可用 Host ID 為 11000000. 00000000. 00000001. 01111110 = 192.0.1.126 (2%)
->共有 2^4-2=14 個可用 Host ID (2%)

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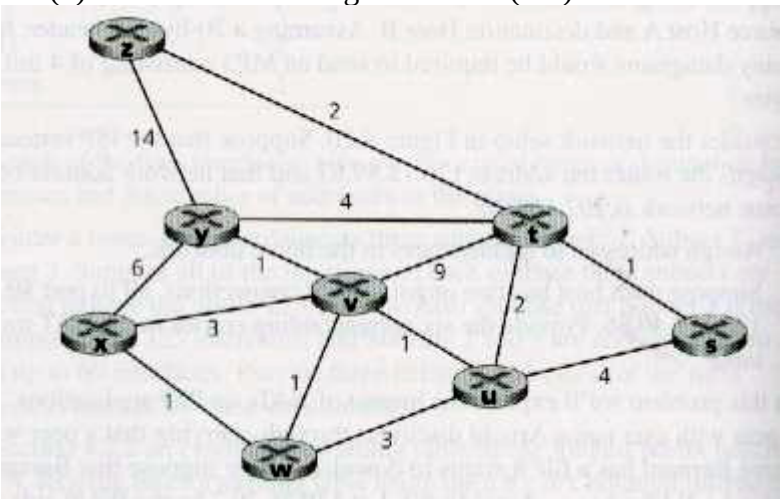
c. IP address, subnet mask, default gateway (3%)

6. Use Dijkstra's shortest-path algorithm to compute the shortest path from w to all network nodes. (a) Show how the algorithm works by computing a table. (數值相同時，優先選字母順序較前者，公式 1% each，表格每列(含箭頭)1%, 14% total) (b) show the forwarding table of w. (7%)



Ans: (1% each, 7% total)

N'	D(s),p(s)	D(t),p(t)	D(u),p(u)	D(v),p(v)	D(x),p(x)	D(y),p(y)	D(z),p(z)
w	∞	∞	3,w	1,w	1,w	∞	∞
wv	∞	a.) 10,v	b.) 2, v		1,w	c.) 2,v	∞
wvx	∞	10,v	2, v			2,v	∞
wvxu	d.) 6, u	e.) 4, u				2,v	∞
wvxuy	6,u	4,u					f.) 16,y
wvxuyt	g.) 5,t						h.) 6,t
wvxuyts							6,t
wvxuytsz							

(1% each, 7% total)

a). D(t) = min{D(t), D(v) + C(v, t)} = min{∞, 1 + 9} = 10

b). D(u) = min{D(u), D(v) + C(v, u)} = min{3, 1 + 1} = 2

c). D(y) = min{D(y), D(v) + C(v, y)} = min{∞, 1 + 1} = 2

d). D(s) = min{D(s), D(u) + C(u, s)} = min{∞, 2 + 4} = 6

e). D(t) = min{D(t), D(u) + C(u, t)} = min{10, 2 + 2} = 4

f). D(z) = min{D(z), D(y) + C(y, z)} = min{∞, 2 + 14} = 16

g). D(s) = min{D(s), D(t) + C(t, s)} = min{6, 4+1} = 5

h). D(z) = min{D(z), D(t) + C(t, z)} = min{16, 4 + 2} = 6

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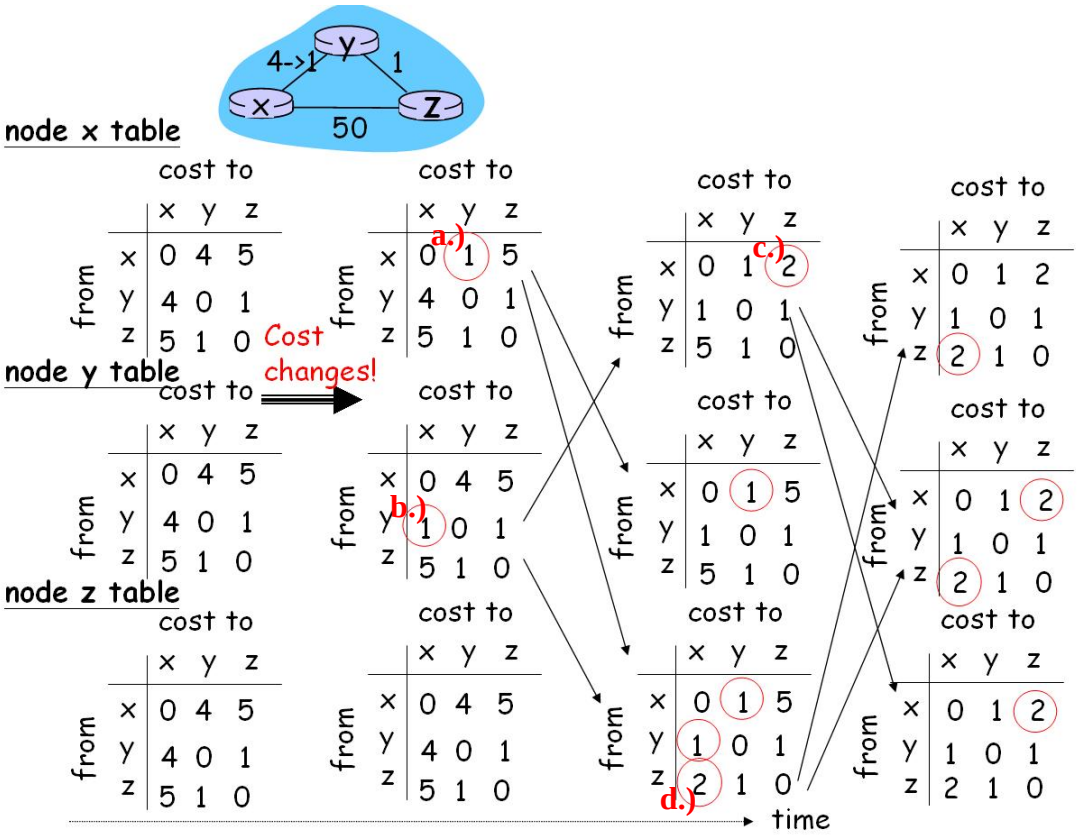
Forwarding table of w: (1% each, 7% total)

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

7. (a) initial table X-Y cost from 4 -> 1
(4 行 table 一行 3% (x, y, z 各看自己那列 1%),共 12%， 2 行箭頭各 1%,共 2% => total 14%)



a). $D_x(y) = \min\{C(x,y) + D_y(y), C(x,z) + D_z(y)\} = \min\{1+0, 50+1\} = 1$

b). $D_y(x) = \min\{C(y,x) + D_x(x), C(y,z) + D_z(x)\} = \min\{1+0, 1+50\} = 1$

c). $D_x(z) = \min\{C(x,z) + D_z(z), C(x,y) + D_y(z)\} = \min\{50+0, 1+1\} = 2$

d). $D_z(x) = \min\{C(z,x) + D_x(x), C(z,y) + D_y(z)\} = \min\{50+0, 1+1\} = 2$

8. Consider sending a 3500-byte datagram into a link that has an MTU of 1500 bytes, including 20-byte IP header. Suppose the original datagram is stamped with the

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identification number 1. List these segments in a table with their data lengths, IDs, flags and offsets. (表格中 data length, offset, flag 每列一分，ID 全部一分。沒有解釋或不清楚，視狀況扣分，10%)

fragment	data lengths	ID	offset	flag
1				
…..				

Ans:

IP data=1500–20=1480Bytes. 1500 Bytes 內 IP data=1480Bytes, 3500 byte-20 byte datagram IP data=3480Bytes,分為 1480, 1480, 520 共 3 個 fragments, 加上 20bytes IP header 後，data length 為 1500, 1500, 540.

fragment	data lengths	ID	offset	flag
1st	1500	1	0	1
2nd	1500	1	1480/8=185	1
3rd	540	1	185*2=370	0

(data length, offset,每列一分，flag、ID 全部一分。沒有解釋或不清楚，視狀況扣分，10%)