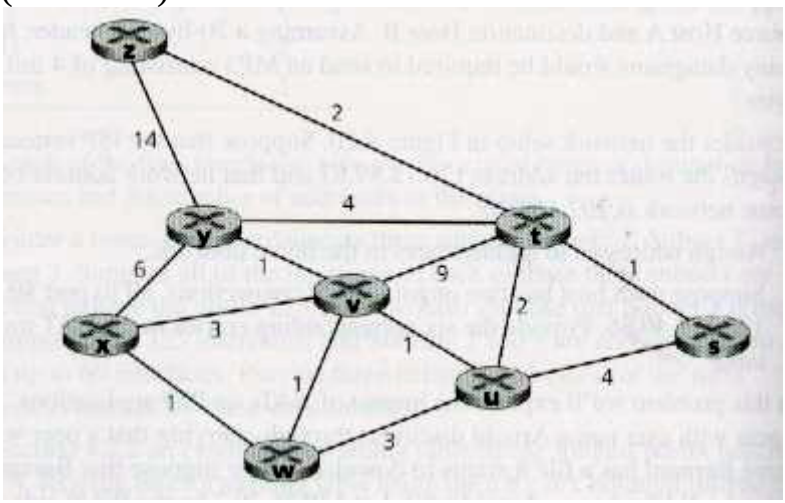
Computer Networks midterm (103/4)

只寫答案而沒有解釋說明，扣一半分數

1. (a)What are the three motivations of IPv6? (3%) (b) Draw a figure to explain how to tunnel IPv6 datagrams between two IPv4 routers? (4%,要說明過程) (7% total)

2. 針對 163.107.172.1 這個 IP address，（以十進位表示，要寫完整過程） (17%)
   a. 這一個 IP 屬於那個 Class 的網路？以二進位說明(1%) 其所屬的 IP 網路表示法為何？(2%) 可用 IP 範圍？(2%) 共有幾個 IP 可用？(1%) mask 的值為何？(1%)
   b. 將此 IP 網路分成 6 subnets，subnet mask 的值為何？(2%) 請列出第 6 個 subnet 的網路表示法 (2%) 可用 IP 範圍？(2%) 共有幾個 IP 可用？(1%)
   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%)

3. Use Dijkstra's shortest-path algorithm to compute the shortest path from z 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%, 16%) (b) show the forwarding table of z. (7%) (23% total)



4. 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% (x, y, z 各看自己那列 1%),共 12%， 2 行箭頭各 1%,共 2% => total 14%)

5. Consider sending a 3580-byte datagram into a link that has an MTU of 980bytes, 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 每列一分，ID, flag 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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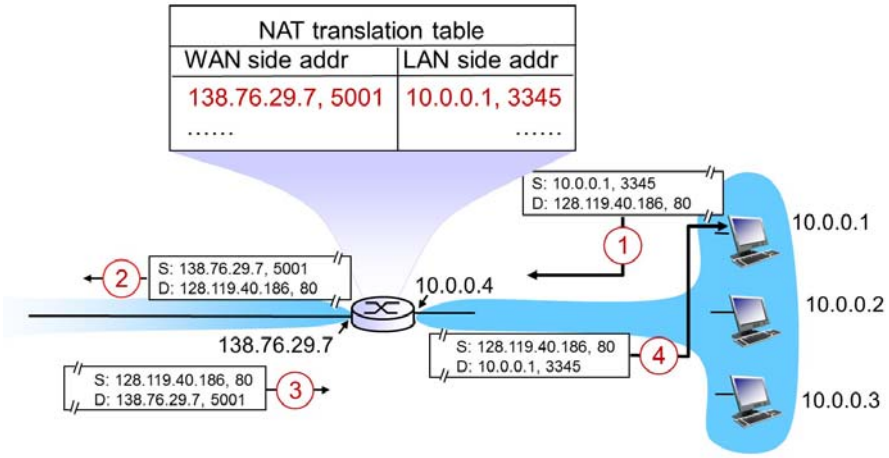
6. Explain four NAT operations with this figure (用圖上的數值說明 8%)



Ans:

7. (a) What is the goal of DHCP? (2%) (b) List four steps of DHCP (8%) (10% total)

8. (a) Draw a figure to show four components of a router (8%) (b) Draw three types of switching fabrics with their names. (1% each, 11% total)

Computer Networks midterm (103/4)

只寫答案而沒有解釋說明，扣一半分數

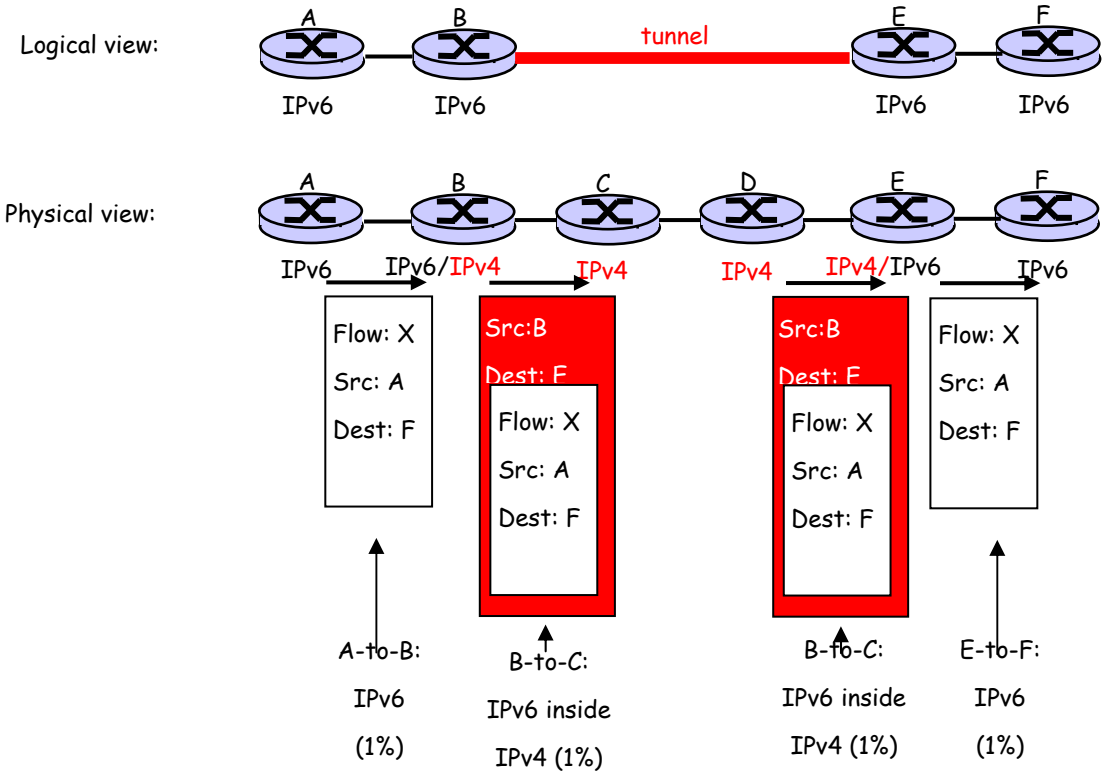
1. (a)What are the three motivations of IPv6? (3%) (b) Draw a figure to explain how to tunnel IPv6 datagrams between two IPv4 routers? (4%,要說明過程) (7% total)

Ans:

(a) (3%)

- 32-bit address space soon to be completely allocated.
- header format helps speed processing/forwarding
- header changes to facilitate QoS

(b)



- 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. (圖上的 2%)
- the new IPv4 datagram is decapsulated in the destination IPv4 router and the original IPv6 datagram is further transmitted through IPv6. (圖上的 2%)

2. 針對 163.107.172.1 這個 IP address，(以十進位表示，要寫完整過程) (17%)
   a. 這一個 IP 屬於那個 Class 的網路？以二進位說明(1%) 其所屬的 IP 網路表示法為何？(2%) 可用 IP 範圍？(2%) 共有幾個 IP 可用？(1%) mask 的值為何？(1%)
   b. 將此 IP 網路分成 6 subnets，subnet mask 的值為何？(2%) 請列出第 6 個 subnet 的網路表示法 (2%) 可用 IP 範圍？(2%) 共有幾個 IP 可用？(1%)
   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.

163.107.172.1 的二進位表示法為 10100011.01101011.XXXXXXXX.XXXXXXXX，由前兩個 bits 10 可判斷為 Class B 的 IP。(1%)

此 IP 所屬於的 Class B 的網路表示法為 163.107.0.0 (2%)

所有 host ID 部分的 16 個 bit 的 X 不可以全為 0 或 1，

因此第一個可用 Host ID 為 10100011.01101011.00000000. 00000001 = 163.107.0.1 (1%)

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最後一個可用 Host ID 為 10100011.01101011.11111111.11111110 = 163.107.255.254 (1%)
->共有 2^{16}-2=65534 個可用 Host ID (1%)
Mask: 255.255.0.0 (1%)

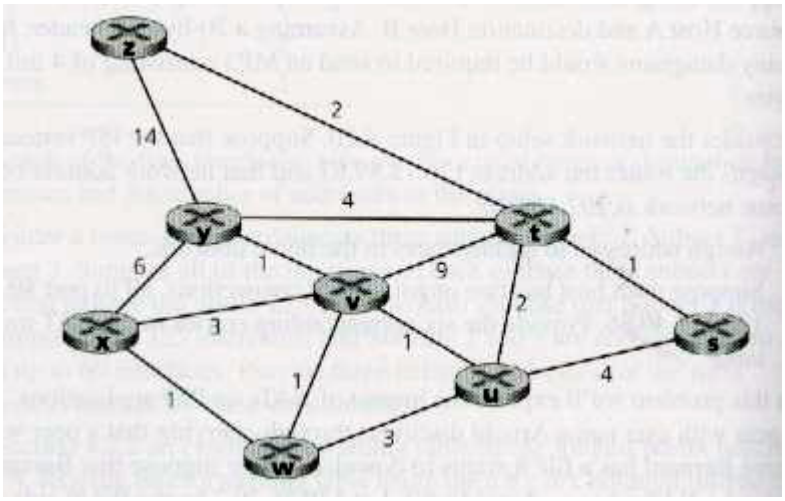
b.

將此 Class B 網路分成 6 個 subnet，加上全為 0 與全為 1 的兩個不能用的 subnet ID，最少需要 6+2=8 <= 2^3, subnet mask 的值 => 需要 Host ID 的前 3 個 bits 當作 subnet ID。所以新的 subnet mask 是由原本 Class B 的 default subnet mask 255.255.0.0 來改，改成 255.255.11100000.00000000=> 255.255.224.0 (2%)

subnet 的 ID 要從此 Class B Network ID 10100011.01101011. XXXXXXXX.XXXXXXXX 來改，需要 Host ID 的前 3 個 bits 當作 subnet ID，不可全為 0 或 1。因此第 6 個 subnet ID 為 10100011.01101011.11000000.00000000 => 163.107.192.0(2%)
因此第一個可用 Host ID 為 10100011.01101011.11000000. 00000001 = 163.107.192.1 (1%)
最後一個可用 Host ID 為 10100011.01101011.11011111. 11111110 = 163.107.223.254 (1%)
->共有 2^{13}-2=8190 個可用 Host ID (1%)

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

3. Use Dijkstra's shortest-path algorithm to compute the shortest path from z 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%, 16%) (b) show the forwarding table of z. (7%) (23% total)



Ans: (1% each, 7% total)

N'	D(s),p(s)	D(t),p(t)	D(u),p(u)	D(v),p(v)	D(w),p(w)	D(x),p(x)	D(y),p(y)
z	∞	2, z	∞	∞	∞	∞	14, z
zt	a)3, t		b) 4, t	c) 11, t	∞	∞	d) 6, t
zts			4, t	11, t	∞	∞	6, t
ztsu				e) 5, u	f) 7, u	∞	6, t
ztsuv					g) 6, v	h) 8, v	6, t
ztsuvw						i) 7, w	6,t
ztsuvwy						7, w	
ztsuvwyx							

(1% each, 9% total)

a). D(s) = min{D(s), D(t) + C(t, s)} = min{∞, 2 + 1} = 3

b). D(u) = min{D(u), D(t) + C(t, u)} = min{∞, 2 + 2} = 4

c). D(v) = min{D(v), D(t) + C(t, v)} = min{∞, 2 + 9} = 11

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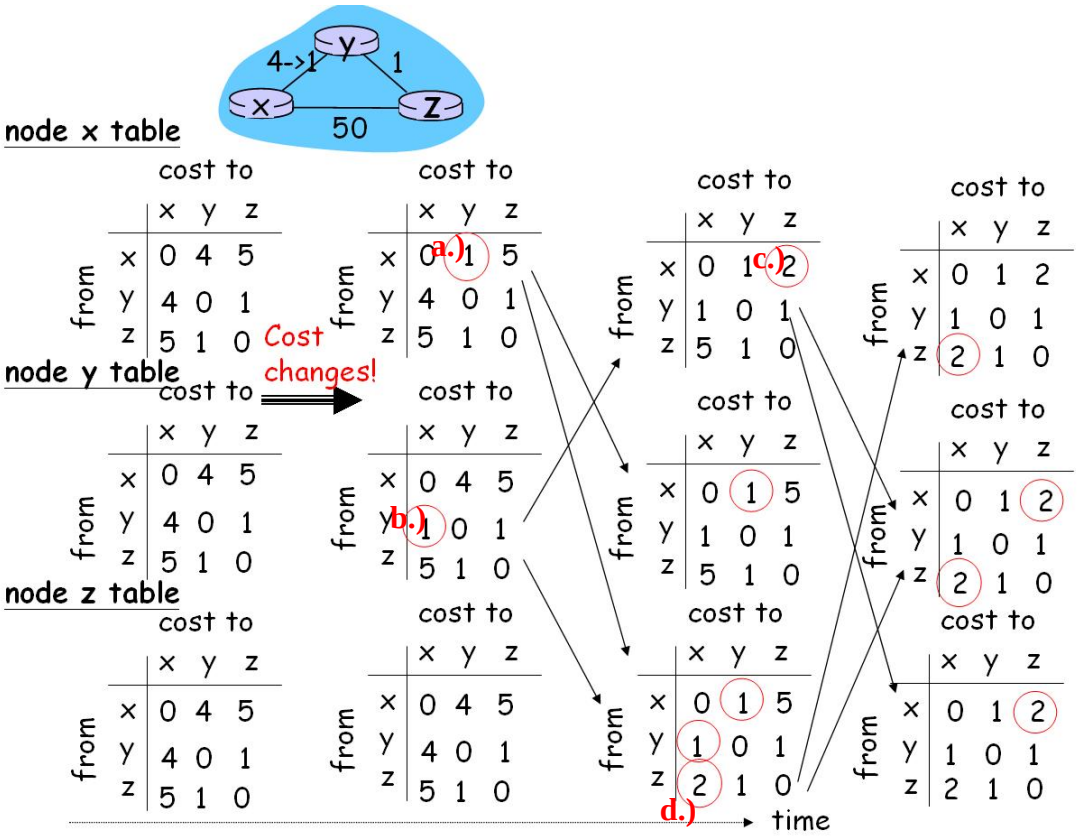
d). $D(y) = \min\{D(y), D(t) + C(t, y)\} = \min\{14, 2 + 4\} = 6$
e). $D(v) = \min\{D(v), D(u) + C(u, v)\} = \min\{11, 4 + 1\} = 5$
f). $D(w) = \min\{D(w), D(u) + C(u, w)\} = \min\{\infty, 4 + 3\} = 7$
g). $D(w) = \min\{D(w), D(v) + C(v, w)\} = \min\{7, 5+1\} = 6$
h). $D(x) = \min\{D(x), D(v) + C(v, x)\} = \min\{\infty, 5 + 3\} = 8$
i). $D(x) = \min\{D(x), D(w) + C(w, x)\} = \min\{8, 6 + 1\} = 7$

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

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

4. 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% (x, y, z 各看自己那列 1%),共 12%， 2 行箭頭各 1%,共 2% => total 14%)

Ans:



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

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5. Consider sending a 3580-byte datagram into a link that has an MTU of 980bytes, 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 每列一分，ID, flag 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				
…..				

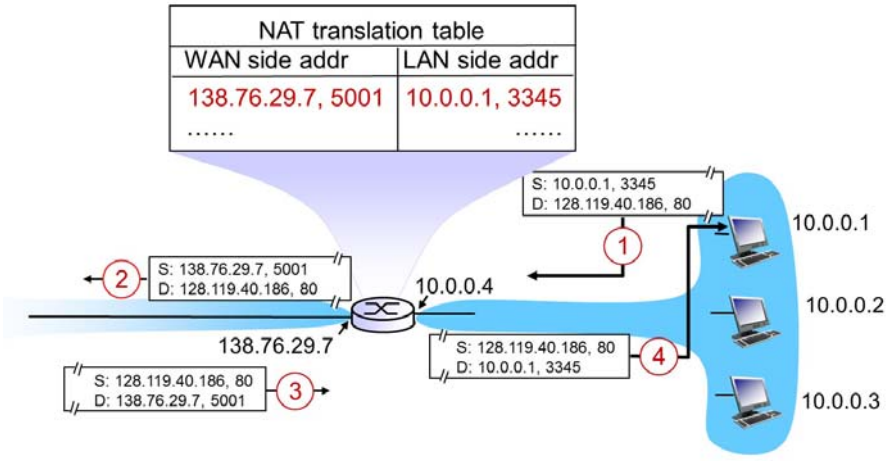
Ans:

IP data=980–20=960Bytes. 980 Bytes 內 IP data=960Bytes, 3580 byte-20 byte datagram IP data=3560Bytes,分為 960, 960, 960, 680 共 4 個 fragments, 加上 20bytes IP header 後，data length 為 980, 980, 980, 700.

fragment	data lengths	ID	offset	flag
1st	980	1	0	1
2nd	980	1	960/8=120	1
3rd	980	1	120*2=240	1
4th	700	1	120*3=360	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%)

6. Explain four NAT operations with this figure (用圖上的數值說明 8%)



Ans:

NAT router must: (8%)

- *outgoing datagrams: replace* (source IP address, port #)=(10.0.0.1, 3345) (1%) of every outgoing datagram to (NAT IP address, new port #)=(138.76.29.7, 5001) (1%)
- *remember (in NAT translation table)* every (source IP address, port #)=(10.0.0.1, 3345) (2%) to (NAT IP address, new port #)=(138.76.29.7, 5001) translation pair (2%)
- *incoming datagrams: replace* (NAT IP address, new port #)=(138.76.29.7, 5001) (1%) in dest fields of every incoming datagram with corresponding (source IP address, port #)=(10.0.0.1, 3345) (1%) stored in NAT table

7. (a) What is the goal of DHCP? (2%) (b) List four steps of DHCP (8%) (10% total)

Ans:

(a) Goal: allow host to *dynamically* obtain its IP address from network server when it joins network (2%)

(b) Flow: (8%)

- host broadcasts "DHCP discover" msg (2%)
- DHCP server responds with "DHCP offer" msg (2%)
- host requests IP address: "DHCP request" msg (2%)
- DHCP server sends address: "DHCP ack" msg (2%)

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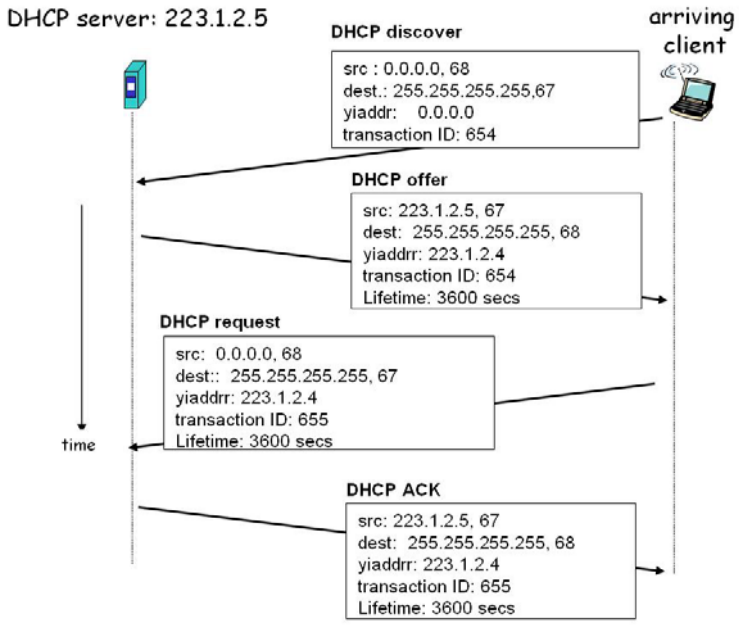
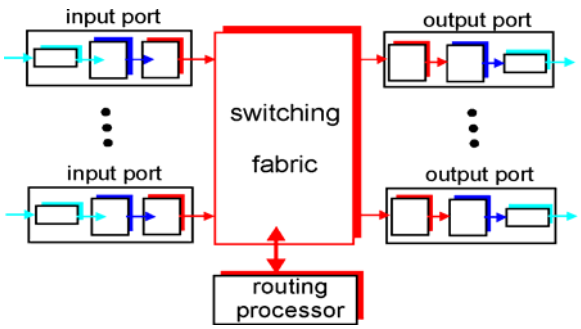


8. (a) Draw a figure to show four components of a router (8%) (b) Draw three types of switching fabrics with their names. (1% each, 11% total)

Ans:

(a) (2% each, 8% total)



(b) (3%)

switching via memory; (1%)

switching via a bus; (1%)

switching via an interconnection network (1%)