Advanced Computer Network Quiz (99/04/08)

1. 針對 IPv4 Class C 網路 (24%)
   a. 求出第一個 Class C 網路可用 IP 範圍？第一個與最後一個可用 IP 各是什麼（以十進位表示，要寫完整過程）(6%) 共有幾個 IP 可用？(3%)
   b. 將第一個 Class C 網路分成 7 個 subnet，subnet mask 的值為何？（以十進位表示，要寫完整過程）(4%) 請列出第一個 subnet 的 ID（以十進位表示，要寫完整過程）(3%)
   c. 什麼是 subnet prefix？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？(8%)
2. Compare characteristics of (a) virtual circuit and (b) datagram network (21% total)
3. Draw a figure to show (a) the router architecture (b) three types of switching fabrics (20% total)
4. How does the traceroute program run with ICMP? (15%)
5. Consider sending a 3000-byte datagram into a link that has an MTU of 500 bytes, including 20-byte IP header. Suppose the original datagram is stamped with the identification number 422. List these segments in a table with their data lengths, IDs, flags and offsets. (表格中 data length, offset, flag, ID 每格 0.5 分。解釋 6%，沒有解釋或不清楚，視狀況扣分，共 20%)

fragment	data lengths	ID	offset	flag
1				
…..				

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1. a.
   第一個 Network ID 為 192.0.1.0，Host ID 表示為 11000000. 00000000. 00000001. XXXXXXXX
   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 (3 分)
   最後一個可用 Host ID 為 11000000. 00000000. 00000001. 11111110 = 192.0.1.254 (3 分)
   ->共有 2^8-2=254 個可用 Host ID (3 分)

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 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 11111111. 11111111. 11111111.11110000 => 255.255.255.240 (4 分)

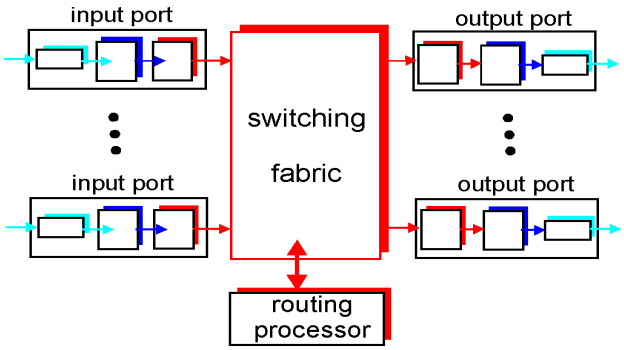
   subnet 的 ID 要從第一個 Class C Network ID 11000000. 00000000. 00000001.00000000 來改，需要 Host ID 的前 4 個 bits 當作 subnet ID，不可全為 0 或 1。因此第一個 subnet ID 為 11000000. 00000000. 00000001.00010000 => 192.0.1.16 (3 分)

c. prefix: class bit+Network ID，表示所屬於的網路;
   IP address, subnet mask, default gateway (8%)

2.
   (a) Virtual circuit (12%)
   - call setup, teardown for each call *before* data can flow
   - each packet carries VC identifier (not destination host address)
   - *every* router on source-dest path maintains "state" for each passing connection
   - link, router resources (bandwidth, buffers) may be *allocated* to VC (dedicated resources = predictable service)

   (b) (9%)
   - no call setup at network layer
   - routers: no state about end-to-end connections
   - packets forwarded using destination host address
     - packets between same source-dest pair may take different paths

3. (20%) (8%)



(a) (4% X 3=12%)

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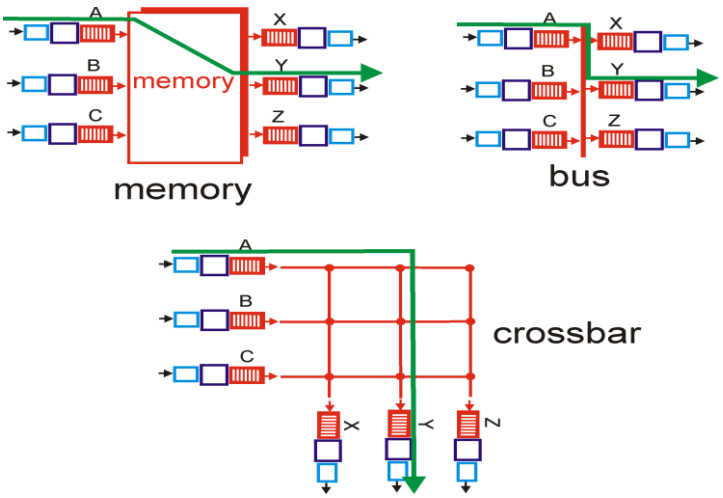

4. Ans:

- Source sends series of UDP segments to dest

  First has TTL =1

  Second has TTL=2, etc. (3%)

  Unlikely port number

  - When nth datagram arrives to nth router: Router discards datagram (3%)

  And sends to source an ICMP message (type 11, code 0) (3%)

  Message includes name of router& IP address

- When ICMP message arrives, source calculates RTT (3%)

  Traceroute does this 3 times

- Stopping criterion

  UDP segment eventually arrives at destination host

  Destination returns ICMP "host unreachable" packet (type 3, code 3)

  When source gets this ICMP, stops. (3%)

5. Ans:

IP data=500–20=480Bytes. 500 Bytes 內 IP data=500-20= 480Bytes, 3000 byte-byte datagram IP data=3000–20=2980Bytes,分為 480, 480, 480, 480, 480, 480, 100 共 7 個 fragments,加上 20bytes IP header 後，data length 為 500, 500, 500, 500, 500, 500, 120.

fragment	data lengths	ID	offset	flag
1st	500	422	0	1
2nd	500	422	480/8=60	1
3rd	500	422	60*2=120	1
4th	500	422	60*3=180	1
5th	500	422	60*4=240	1
6th	500	422	60*5=300	1
7th	120	422	60*6=360	0

(表格中 data length, offset, flag, ID 每格 0.5 分。沒有解釋或不清楚，視狀況扣分，解釋 6%，共 20%)