Computer Networks Final (105/1)

只寫答案而沒有解釋說明，扣一半分數

1. (a)Which tool allows the host running the tool to query any specified DNS server for a DNS record? (2%)
   (b) How to run the tool in (a) to execute "Please send me the host names of the authoritative DNS for ntu.edu.tw" operation? (4%)
   (c) How to run the tool in (a) to execute "Please send me the host names of *www.ncue.edu.tw*, but we want to the query sent to the DNS server *dns.ntu.edu.tw* rather than to the default DNS server" operation? (4%)
   (d) Which tool can be used to show your all TCP/IP information? (2%)
   (e) How to see these cached records of the DNS cache in your host? (2%) (14% total)

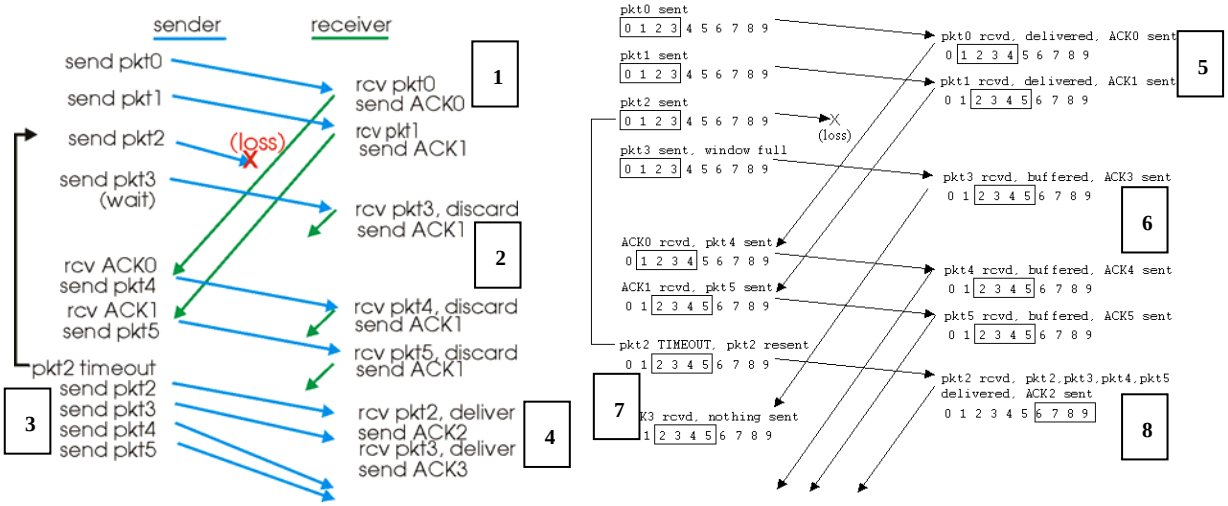
2. (a) List TCP seven characteristics (7%) (b) Why is there a UDP? (4%) (11% total)

3. (a) Explain how TCP Fast Retransmit works. (3%) (24% total)
   (b) How TCP does its flow control? (3%)
   (c) What values are used by TCP and UDP to identify their sockets? (6%)
   (d) Describe four operations to provide reliable data transfer over channels with errors and loss? (8%)
   (e) Explain the "**tracker**" and "**torrent**" in BitTorrent. (4%)

4. 針對 220.107.172.1 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 12 subnets，subnet mask 的值為何？(2%) 請列出第 1 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%)

5. Draw the flow of the TCP three way handshake to explain its operations. Suppose the initial sequence numbers of the client and the server are 99 and 2, respectively. 必須在圖上分別清楚標示出 TCP 必要的 flag, sequence number, and ACK number. (10%)

6. List and compare two pipelined transport protocols with these two figures. (寫出 Window=? 與各標號處的動作 10%)



7. Describe how TCP Reno does its congestion control. (8%)

8. What are the two key network-layer functions in a datagram network? (名稱 2%, 說明 1%, 6% total)

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   (d) Which tool can be used to show your all TCP/IP information? (2%)
   (e) How to see these cached records of the DNS cache in your host? (2%)
   (14% total)

Ans:

(a) *nslookup* (2%)
(b) nslookup –type=NS ntu.edu.tw (4%)
(c) nslookup www.ncue.edu.tw dns.ntu.edu.tw (4%)
(d) ipconfig /all (2%)
(e) ipconfig /displaydns (2%)

2. (a) List TCP seven characteristics (7%) (b) Why is there a UDP? (4%) (11% total)

Ans:

(a) (7%)

- point-to-point: one sender, one receiver
- reliable, in-order byte stream:
- pipelined: TCP congestion and flow control set window size
- send & receive buffers
- full duplex data: bi-directional data flow in same connection
- connection-oriented: handshaking (exchange of control msgs) init's sender, receiver state before data exchange
- flow controlled: sender will not overwhelm receiver

(b) (4%)

- no connection establishment (which can add delay) (1%)
- simple: no connection state at sender, receiver
- small segment header
- no congestion control: UDP can blast away as fast as desired

3. (a) Explain how TCP Fast Retransmit works. (3%) (24% total)
   (b) How TCP does its flow control? (3%)
   (c) What values are used by TCP and UDP to identify their sockets? (6%)
   (d) Describe four operations to provide reliable data transfer over channels with errors and loss? (8%)
   (e) Explain the "**tracker**" and "**torrent**" in BitTorrent. (4%)

Ans:

(a) Explain how TCP Fast Retransmit works. (3%)
    If sender receives 3 ACKs for the same data, (1%) it supposes that segment after ACKed data was lost (1%): resend segment before timer expires (1%) (3% total)
(b) How TCP does its flow control? (3%)
    Rcvr advertises spare room by including value of **RcvWindow** in segments (1%)
    Sender limits unACKed data to **RcvWindow** (1%) for guaranteeing receive buffer doesn't overflow (1%)
(c) UDP socket identified by two-tuple: (dest IP address, dest port number) (2%)
    TCP socket identified by 4-tuple: (4%)
    source IP address

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source port number
dest IP address
dest port number

(d) sender adds *sequence number* to each pkt to detect duplicate pkts (2%)
receiver uses checksum to detect bit errors (2%)
receiver sends ACK with seq # of last pkt received OK (2%)
sender waits "reasonable" amount of time for ACK, retransmits if no ACK received in this time (2%)

(e) tracker: tracks peers participating in torrent; (2%)
torrent: group of peers exchanging chunks of a file (2%)

4. 針對 220.107.172.1 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 12 subnets，subnet mask 的值為何？(2%) 請列出第 1 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.

220.107.172.1 的二進位表示法為 11011100.XXXXXXXX.XXXXXXXX.XXXXXXXX，由前 3 個 bits 0 可判斷為 Class C 的 IP。(1%)
此 IP 所屬於的 Class C 的網路表示法為 220.107.172.0 (2%)
所有 host ID 部分的 8 個 bit 的 X 不可以全為 0 或 1，
因此第一個可用 Host ID 為 220.107.172. 00000001 = 220.107.172.1 (1%)
最後一個可用 Host ID 為 220.107.172.11111110 = 220.107.172.254 (1%)
->共有 2^8-2=254 個可用 Host ID (1%)
Mask: 255.255.255.0 (1%)

b.

將此 Class A 網路分成 12 個 subnet，加上全為 0 與全為 1 的兩個不能用的 subnet ID，最少需要 12+2=14 <= 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 要從此 Class C Network ID 220.107.172.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 1 個 subnet ID 為 220.107.172.00010000 => 220.107.172.16 (2%)
因此第一個可用 Host ID 為 220.107.172. 00010001 = 220.107.172.17 (1%)
最後一個可用 Host ID 為 220.107.172. 00011110 = 220.107.172.30 (1%)
->共有 2^4-2=14 個可用 Host ID (1%)

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

5. Draw the flow of the TCP three way handshake to explain its operations. Suppose the initial sequence numbers of the client and the server are 99 and 2, respectively. 必須在圖上分別清楚標示出 TCP 必要的 flag, sequence number, and ACK number. (10%)

Ans: Three way handshake:

Step 1: client host sends TCP SYN segment to server (搭配圖要正確 2%)
Step 2: server host receives SYN, replies with SYNACK segment (4%)
Step 3: client receives SYNACK, replies with ACK segment, which may contain data (4%)

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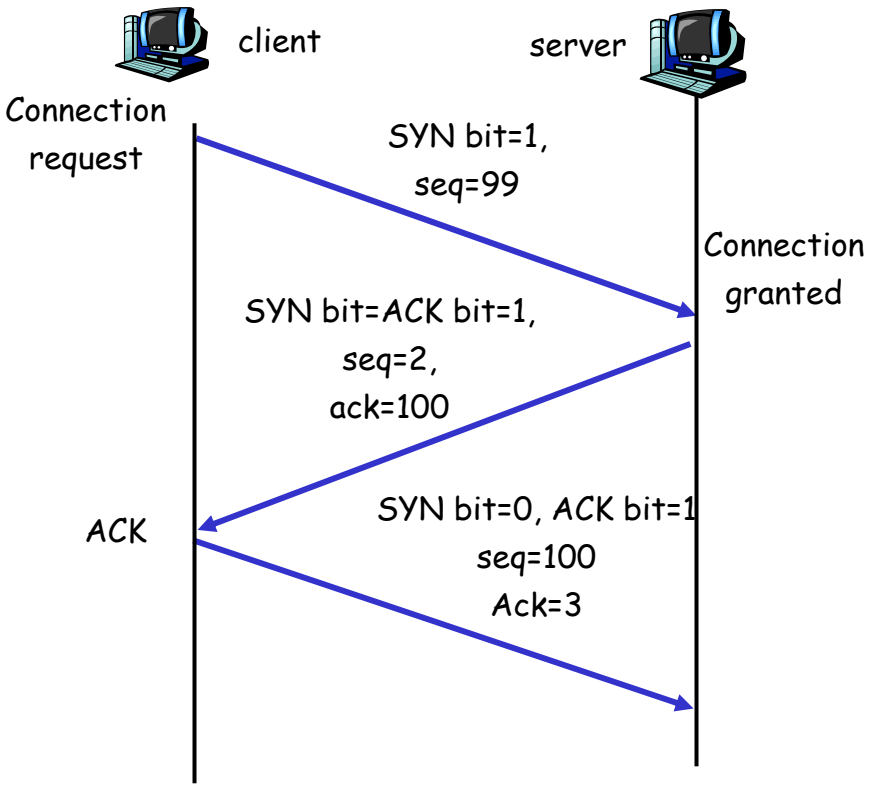


上圖每個符號含內容 1 分，標示不全者，視狀況扣分，共 10 分

6. List and compare two pipelined transport protocols with these two figures. (寫出 Window=? 與各標號處的動作 10%)

Ans:

Go-back-N (5%)

- "window" of up to N, consecutive unack'ed pkts allowed (<u>window = 4</u>) (1%)

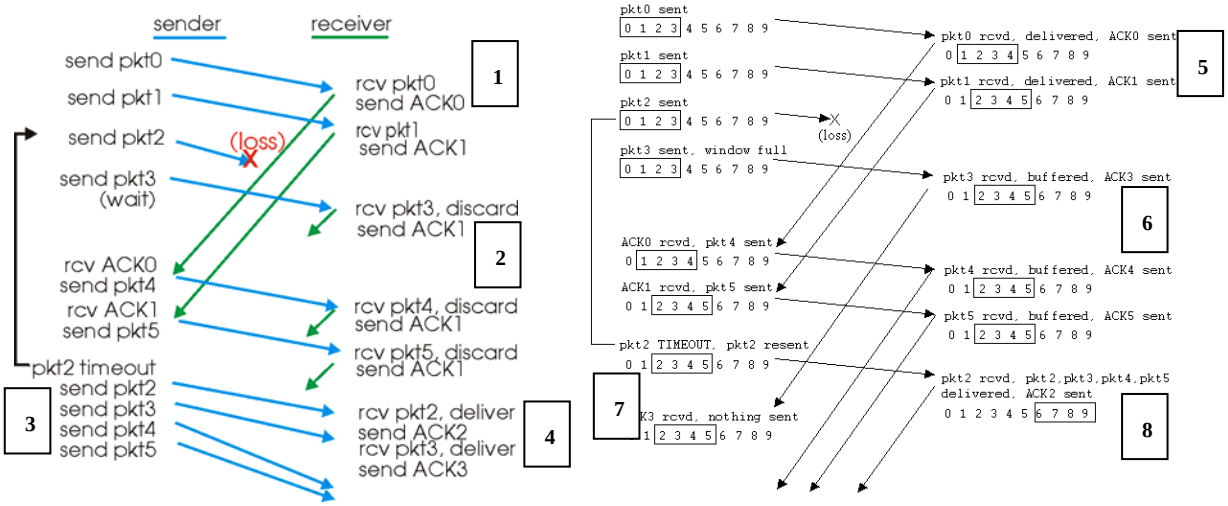
(1) ACK-only: always send ACK for correctly-received pkt with highest *in-order* seq # (1%)

(2) out-of-order pkt:

- discard (don't buffer) -> no receiver buffering! (1%)
- Re-ACK pkt with highest in-order seq # (1%)

(3) timeout(n): retransmit pkt n and all higher seq # pkts in window (1%)

(4) deliver in-order segments to upper layer. (1%)



Selective Repeat (4%)

(5) receiver *individually* acknowledges all correctly received pkts (1%)

(6) buffers out-of order pkts (1%)

(7) sender only resends pkts for which ACK not received when timeout (1%)
(8) deliver total in-order pkts to upper layer (1%)

7. Describe how TCP Reno does its congestion control. (8%)
Ans: (8%)
When **CongWin** is below **Threshold** (1%), sender in slow-start phase, window grows exponentially (1%).
When **CongWin** is above **Threshold** (1%), sender is in congestion-avoidance phase, window grows linearly (1%).
When a triple duplicate ACK occurs (1%), **Threshold** set to **CongWin/2** and **CongWin** set to **Threshold** (1%).
When timeout occurs (1%), **Threshold** set to **CongWin/2** and **CongWin** is set to 1 MSS (1%).

8. What are the two key network-layer functions in a datagram network? (名稱 2%, 說明 1%, 6% total)
Ans: forwarding: move packets from router's input to appropriate router output
routing: determine route taken by packets from source to dest. (名稱 2%, 說明 1%, 6% total)