國立臺灣科技大學

考試科目： Computer Networks   106學年度第 2 學期 博士班考試命題用紙

考試　月　日（星期　）上午　下午第　節　時間　分鐘

□研究所 □大學部 □工程在職進修　系所　班別：

任課教師　第 1 / 頁共 2 頁

命題請勿超出線外

1, (20%) When a computer named "networking.csie.ntust.edu.tw" in NTUST wants to send a packet to another computer named "cloud.csie.ntu.edu.tw" in NTU. Assume the DNS cache is empty in the computer "networking.csie.ntust.edu.tw". To get the IP address of the computer "cloud.csie.ntu.edu.tw", the computer "networking.csie.ntust.edu.tw" needs to do a DNS query and there are multiple levels of DNS servers. Please draw the DNS message flow for both iterated query and recursive query in Figure 1 by using arrows.

Figure 1

2, (a) (5%) What is the difference between UDP and TCP? (write two difference features)

(b) (5%) In TCP Reno, please tell me what are congestion control and flow control.

3, (20%) TCP initializes a new connection by three-way handshaking, which is composed of three message exchanges as Figure 2. Assume the segment size is 1 byte and the sequence numbers of the message (a) and message (b) are 10. What is the sequence number, ACK numbers, SYN flag, and ACK flag of the message (a), (b), and (c)

Figure 2

4, (20%) Assume currently TCP CWND (TCP Reno) at a sender side is as shown in Figure 3. Then, the sender receives a packet with ack number = 7: (a) if the TCP Reno is in slow start phase, how to adjust the TCP CWND? (including the sequence number that the CWND start from and the size of CWND), (b) if the TCP Reno is in congestion avoidance phase, how to adjust the TCP CWND? (including the sequence number that the CWND start from and the size of CWND).

1	2	3	4	5	6	7	8	9

Figure 3

5, (30%) The network topology is as shown in Figure 4. Please use Dijkstra's algorithm to get the shortest path tree starting from "node a" and show the tree by filling up Table 1.
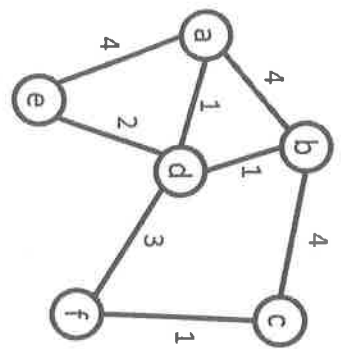

Figure 4

P.S. the numbers next to links are the cost of the links.
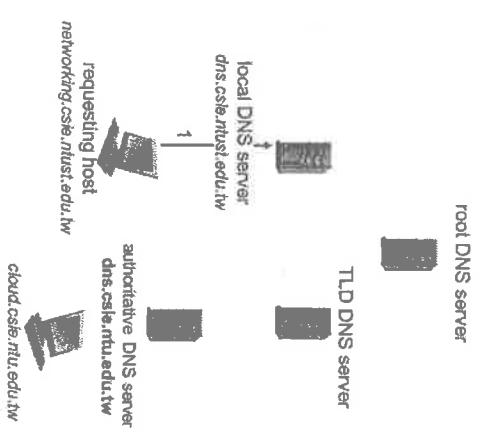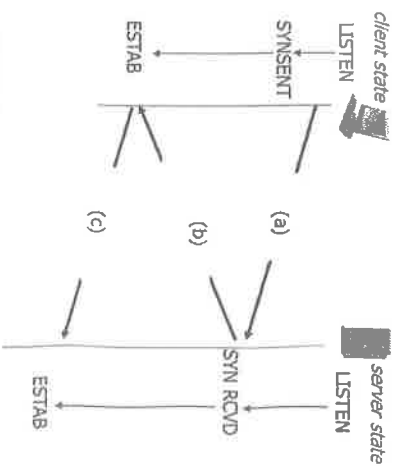D(b) represents the total cost of the shortest path from a to b.

Step	N'	D(b)	D(c)	D(d)	D(e)	D(f)
0						
1						
2						
3						
4						
5						

Table 1

國立臺灣科技大學　106學年度第一學期博士班考試命題用紙

考試科目：Computer Networks

考試時間（星期 ）下午上午第 節

□研究所□大學部□工程在職進修

命題請勿超出線外

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6. Current Internet Protocol version 4, or IPv4, has its public addresses exhausted. Many organizations adopt network address translation, or NAT, to save their usage of public IP address.

   (a) (6%) There are in total three private address blocks defined by IETF. One is 172.16.0.0/12, what are the other two blocks?

   (b) (9%) Describe how to run a public HTTP server inside a private network via NAT

7. Transport Layer Security, or TLS, is a cryptographic protocol that provides communications security over a computer network.

   (a) (6%) Name two common application protocols that use the help of TLS to realize data confidentiality and integrity.

   (b) (4%) network servers that support TLS would send digital certificate, which is usually issued by third party, to clients during handshaking process. What is the function of the certificate?

8. Address Resolution Protocol, or ARP, is a communication protocol used for discovering the link layer address, such as a MAC address, associated with a given network layer address, typically an IPv4 address.

   (a) (9%) Illustrate the process how one computer may find the MAC address of another computer via ARP.

   (b) (6%) At what situation one computer might want to query for the corresponding IP address by a MAC address? and what protocol solves this purpose?

9. (10%) Describe how TCP may use timestamp option to measure round trip time, or RTT? Give at least two types of time factors that affect the accuracy of the estimated RTT.