

# 國立臺北科技大學

一百零二學年第一學期電機系博士班資格考試

## 網際網路工程 試題

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### 注意事項：

1. 本試題共【7】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. (15 points) Suppose there are two ISPs providing WiFi access in a particular café, with each ISP operating its own AP and having its own IP address block. Further suppose that by accident, each ISP has configured its AP to operate over channel 8. Will the 802.11 protocol completely break down in this situation? Discuss what happens when two stations, each associated with a different ISP, attempt to transmit at the same time.
2. (15 points) Consider the topology shown in the following Figure 1.
  - (a) Assign network address to each of these six subnets, with the following constraints: All addresses must be allocated from 214.97.254/23; Subnet A should have enough addresses to support 250 interfaces; Subnet B should have enough addresses to support 120 interfaces; and Subnet C should have enough addresses to support 120 interfaces. Subnets D, E, and F should each be able to support two interface. For each subnets, the assignment should take the form a.b.c.d/x or a.b.c.d/x -- e.f.g.h/y.
  - (b) Using your answer to part (a), provide the following tables (using longest prefix matching) for each of the three routers.

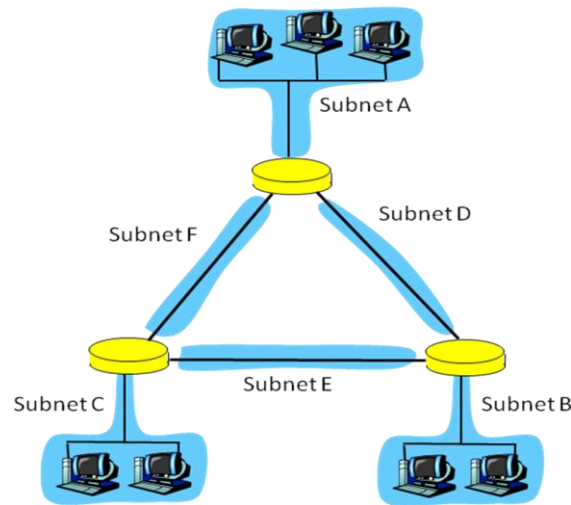


Figure 1

3. (15 points) Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS look-up is necessary to obtain the IP address. Suppose that  $n$  DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of  $RTT_1, \dots, RTT_n$ . Let  $RTT_0$  denote the RTT between the local host and the server containing the object. Suppose the HTML file references three very small objects on the same server. Neglecting transmission times, how much time elapses with
  - (a) Nonpersistent HTTP with no parallel TCP connections?
  - (b) Nonpersistent HTTP with parallel connections?
  - (c) Persistent HTTP with pipelining?
  
4. (15 points) Suppose Alice wants to communicate with Bob using symmetric key cryptography using a session key  $K_S$ . In this problem, we explore how the session key can be distributed using a key distribution center (KDC). The KDC is a server that shares a unique secret symmetric key with each registered user. For Alice and Bob, denote these keys by  $K_{A-KDC}$  and  $K_{B-KDC}$ . Design a scheme that uses the KDC to distribute  $K_S$  to Alice and Bob. Your scheme should use three message to distribute the session key: a message from Alice to the KDC; a message from KDC to Alice; and finally a message from Alice to Bob. The first message is  $K_{A-KDC}(A,B)$ . Using the notation,  $K_{A-KDC}$ ,  $K_{B-KDC}$ ,  $K_S$ , A, and B provide the protocol.

5. (10 points) A is at her PC and she wants to call B, who is also working at his PC. A's and B's PCs are both equipped with SIP-based software for making and receiving phone calls. Assume that A knows the IP address of B's PC. Illustrate the SIP call-establishment process.
6. (15 points) Let  $T$  (measured by RTT) denote the time interval that a TCP connection takes to increase its congestion window size from  $W/2$  to  $W$ , where  $W$  is the maximum congestion window size. Argue that  $T$  is a function of TCP's average throughput.
7. (15 points) Consider a network in which all nodes are connected to three other nodes. In a single time step, a node can receive all transmitted broadcast packets from its neighbors, duplicate the packets, and send them to all of its neighbors (except to the node that send a given packet). At the next time step, neighboring nodes can receive, duplicate, and forward these packets, and so on. Suppose that uncontrolled flooding is used to provide broadcast in such a network. At time step  $k$ , how many copies of the broadcast packet will be transmitted, assuming that during time step 1, a single broadcast packet is transmitted by the source node to its three neighbors.