國立雲林科技大學資訊管理系

114 學年度第 1 學期博士班資格考 (Ph.D. Qualify Exam)

考試科目 (Subject)：資訊網路 (Computer Networking)

時數與方式 (Hour and type)：~~四小時 (4 hours)~~ 3.5小時(3.5 hours)

Close book, 不可使用計算器 (Calculators not allowed)

Part 1: 50 points (Optional Questions: Answer 5 out of 7, 10 points each; if you answer more than 5 questions, only the first 5 answered questions will be graded.)

1. Answer true or false and briefly justify your answer: (2% each)
   a. The size of the TCP rwnd might change throughout the duration of the connection.
   b. When IPv6 tunnels through IPv4 routers, the underlying mechanism is encapsulation in IPv4.
   c. The Alternating-Bit protocol is the same as the Selective-Repeat protocol with a sender and receiver window size of 1.
   d. With nonpersistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
   e. Suppose Host A sends one segment with sequence number 38 and 4 bytes of data over a TCP connection to Host B. In this same segment, the acknowledgment number is necessarily 42.
2. What are the five layers in the Internet protocol stack? (5%) What are the principal responsibilities and protocols associated with each layer? (5%)
3. The bad guys attempt to wreak havoc in our daily lives by damaging our Internet-connected computers, violating our privacy, and rendering inoperable the Internet services on which we depend. List some of the prevalent types of attacks today. (10%)
4. List five nonproprietary Internet applications (5%) and the application-layer protocols and underlying transport-layer protocols that they use. (5%)
5. List the four broad classes of services that a transport protocol can provide. (4%) For each of the service classes, indicate if either UDP or TCP (or both) provides such a service. (4%) Describe why an application developer might choose to run an application over UDP rather than TCP. (2%)
6. Suppose that a Web server runs in Host C on port 80. Suppose this Web server uses **persistent** connections, and is currently receiving requests from two different Hosts, A and B. Are all of the requests being sent through the same socket at Host C? (1%) If they are being passed through different sockets, do both of the sockets have port 80? (1%) Discuss and explain. (8%)
7. Name three header fields in an IP datagram that **can** be **matched** in Open-Flow 1.0 generalized forwarding. (3%) What are three IP datagram header fields that **cannot** be **matched** in OpenFlow? (3%) Compare and contrast the IPv4 and the IPv6 header fields. Give four fields in common. (4%)

Part 2: 50 points (All questions are mandatory.)

8. Consider the routing algorithms. (16 points)
   a. Compare the following approaches:
      i. Centralized routing algorithms vs. decentralized routing algorithms (4%)
      ii. Static routing algorithms vs. Dynamic routing algorithms (4%)
      iii. Load-sensitive algorithms vs. load-insensitive algorithms (4%)
   b. Which of the eight combinations of the above approaches is the most popular practice nowadays? (4%)
9. Suppose four active nodes—nodes A, B, C, and D—compete for channel access using slotted ALOHA. Assume each node has an infinite number of packets to send. Each node attempts to transmit in each slot with probability p. The first slot is numbered slot 1, the second slot is numbered slot 2, and so on. (16 points)
   a. What is the probability that node A succeeds for the first time in slot 4? (4%)
   b. What is the probability that some node (A, B, C, or D) succeeds in slot 5? (4%)
   c. What is the probability that the first success occurs in slot 4? (4%)
   d. What is the efficiency of this four-node system? (4%)
10. Suppose two ISPs provide WiFi access in a particular café, with each ISP operating its own AP and having its own IP address block. (9 points)
   a. Further suppose that by accident, each ISP has configured its AP to operate over channel 11. Discuss what happens when two stations, each associated with a different ISP, attempt to transmit simultaneously. (5%)
   b. Now, one AP operates over channel one and the other over channel 11. Discuss what happens when two stations, each associated with a different ISP, attempt to transmit simultaneously. (4%)
11. Suppose Alice wants to send an email to Bob. Bob has a public-private key pair (K_B^+, K_B^-), and Alice has Bob's certificate. But Alice does not have a public, private key pair. Alice and Bob (and the entire world) share the same hash function H(·). (9 points)
   a. In this situation, is it possible to design a scheme so that Bob can verify that Alice created the message? If so, show how with a block diagram for Alice and Bob. (5%)
   b. Is it possible to design a scheme that provides confidentiality when sending messages from Alice to Bob? If so, show how with a block diagram for Alice and Bob. (4%)