THE UNIVERSITY OF ADELAIDE
AUSTRALIA

SUB CRUCE LUMEN

Primary Examination, Semester 1, 2013

Computer Networks and Applications
COMPSCI 3001, 7039,

Official Reading Time:	10 mins
Writing Time:	120 mins
Total Duration:	130 mins

Questions	Time	Marks
Answer all 5 questions	120 mins	120 marks 120 Total

Instructions

- Begin each answer on a new page in the answer book.
- Examination material must not be removed from the examination room.

Materials

- Calculator without alphanumeric memory or remote communications capability permitted.
- Foreign language paper dictionaries permitted.

DO NOT COMMENCE WRITING UNTIL INSTRUCTED TO DO SO

Application Layer

Question 1

(a) List two causes of network latency (i.e. delay in sending data). For each of the causes you list, explain how the latency due to that cause is calculated.

[4 marks]

(b) You want to send 10GBytes of videos to a friend. You have a choice of burning them to DVD and sending by express post, which will take 1 day (24 hours) for them to arrive or you can send them by Internet on which you get an average upload data rate of 2Mb/sec. Show which method will be faster. You must show your work, no marks for just guessing an answer.

[5 marks]

(c) Why don't SMTP servers just require all senders to be authenticated before accepting mail?

[3 marks]

(d) Explain how caching is used in the Domain Name System (DNS) during an iterative query. Specify what information is cached at the local host, the local DNS, the root DNS, the Top Level Domain (TLD) DNS and the authoritative DNS. Be sure to include only cached information not all information stored.

[5 marks]

(e) HTTP 1.1 introduced the use of persistent connections for downloading web objects. Explain why this improves performance over a connection using TCP congestion control (i.e. AIMD as used in TCP Reno and Tahoe)

[4 marks]

(f) Under what conditions will distributing a file by a client-server architecture be faster than distributing the file by a peer to peer architecture.

[4 marks]

[Total for Question 1: 25 marks]

Transport Layer

Question 2

(a) Reliable transport protocols must have at least a unique sequence number for each segment in the window. However, the protocol used can have additional requirements on the minimum unique sequence numbers beyond this requirement.

i. What is the minimum number of unique sequence numbers required for the Go Back N protocol?

[2 marks]

ii. What is the minimum number of unique sequence numbers required for the Selective Repeat protocol?

[2 marks]

iii. What is the consequence if these minimum requirements are not met? Give an explanation of precisely why or how they will fail. You may use an example of a failure case or an explanation, but must provide either a general explanation that covers both selective repeat and go back n or a failure case for each of the protocols.

[4 marks]

(b) The measured average round trip delay on a connection is 50 msec. If the link has a bandwidth of 1Gb/sec, what is the minimum number of Bytes that should be available in the window so that the transfer of the data does not become stop and wait?

[4 marks]

(c) Why does TCP change congestion control behaviour at a threshold value? Specifically what is the significance of the threshold value that makes it the logical point to change from exponential growth to linear growth?

[4 marks]

(d) What, other than congestion control, limits the sending rate to TCP? Explain how this other limit works.

[4 marks]

(e) TCP's 4-way handshake used to terminate connections does not guarantee that both sides of the connection will close. Explain why this is and what TCP does to try to maximise the chance that both sides of the connection close once a termination request is sent. You may use an example or diagram.

[4 marks]

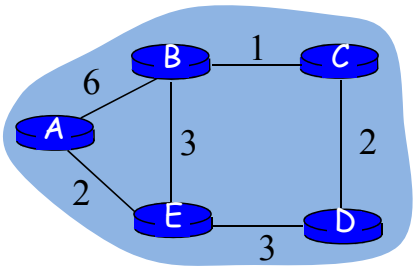
[Total for Question 2: 24 marks]

Internet Protocol

Question 3

(a) Given an example of a link state routing protocol you have come across in your course.

[1 mark]



cost to destination via

$D^B()$	A	E	C
A			
E			
D			
C			

destination

Figure 1: Distance Vector Routing.

(b) Figure 1 is a diagrammatical depiction of a network of routers with link costs. Copy the table given in the figure and complete the distance table using the Distance Vector routing algorithm executed at node B. Assume that routing loops are prevented. Finally indicate in a table the resulting routing table.

[8 marks]

(c) What is the binary equivalent of the IP address 223.1.3.27?

[2 marks]

(d) It is said that when IPv6 tunnels through IPv4 routers, IPv6 treats the IPv4 tunnels as link-layer protocols. Do you agree with this statement? Why or why not?

[2 marks]

(e) Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of the three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support upto 125 interfaces, and Subnect 2 and 3 are each required to support up to 60 interfaces. Provide three network addresses (of the form `a.b.c.d/x`) that satisfy these constraints.

[3 marks]

(f) IPv6 removed fragmentation in routers. Explain how IPv6 deals with different maximum transmission units (MTUs) of different links along a path. What is the advantage of this approach when compared to IPv4 fragmentation?

[4 marks]

(g) Consider sending a 3,000 byte datagram into a link that has an MTU of 700 bytes. Suppose the orginal datagram is stamped with identification number 422. How many fragments are generated? Give the values of the various related header fields of each fragment sent using IPv4.

[5 marks]

[Total for Question 3: 25 marks]

Link Layer Protocols

Question 4

(a) If clients listen for an empty link before transmitting, how is it possible that collisions can occur?

[2 marks]

(b) "All links are error-prone and no link with errors can be made error-free." Carefully explain whether it is true or false based on what you have learned regarding the link layer, the physical layer and strategies employed for error correction.

[4 marks]

(c) The generator function G for your Layer 2 Protocol's Cyclic Redundancy Check is 1001. You have received the data D, 101000011. Answer the following questions with reference to G and D. You may assume that any error detection bits are found after the data bits.

i. What is the largest burst error that we can detect with G?

[1 mark]

ii. Which of the bits in D are the error detection bits and what is their value?

[2 marks]

iii. Has this data been transmitted correctly? Provide all working required to justify your answer.

[5 marks]

(d) Your corporate network incorporates an MPLS network purchased from an ISP to link your US and Australian offices. Explain how a packet in your offices in Sydney is routed through the MPLS network to arrive in San Francisco.

[6 marks]

(e) Why do we need to send an acknowledgement in 802.11 protocols when a frame is successfully received?

[4 marks]

(f) What is the role of the `Spanning Tree Protocol` in Layer 2 networks?

[3 marks]

(g) Why would token ring protocol be inefficient if a LAN had a very large perimeter? Explain your answer in terms of the average length of frame length, L (bytes), and the transmission rate of the links, R (bytes per second) and propagation delay.

[3 marks]

(h) Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within frame with a specific destination MAC address?

[2 marks]

[Total for Question 4: 32 marks]

ICMP, SNMP and Security

Question 5

(a) What is the an important difference between a request-response message and a trap message in SNMP?

[2 marks]

(b) Explain why a message hash is used for digital signatures rather than just using the private key to encrypt the message?

[2 marks]

(c) Does public key cryptography alone prevent a "man-in-the-middle" attack? Explain your answer, using a diagram.

[6 marks]

(d) Explain the use of a *nonce* in a challenge-response protocol.

[4 marks]

[Total for Question 5: 14 marks]

End of exam