53 (CS 815) TDIM

2018

DESIGN AND IMPLEMENTATION

Paper : CS 815

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***all*** *questions.*

1. Attempt ***any one*** of the following :

   a. Consider the *queuing delay* in a *router buffer* (preceding an outbound link). Suppose all packets are L bits, the *transmission rate* is R bps, and that N packets simultaneously arrive at the buffer every LN/R seconds. Find the *average queuing delay* of a packet. (Hint: The queuing delay for the first packet is zero; for the second packet L/R; for the third packet $2L/R$. The "Nth packet has already been transmitted when the second batch of packets arrives) 10

b. Generalize the *end-to-end delay formula* for heterogeneous *processing rates, transmission rates* and *propagation delays.* 10

2. a. *TCP* can be enhanced with *SSL* to provide process-to-process security services, including *encryption.* Does *SSL* operate at the *transport layer* or the *application layer* ? If the application developer wants *TCP* to be enhanced with *SSL,* what does the developer has to do ? 10

b. Consider an e-commerce site that wants to keep a purchase record for each of its customers. Describe how this can be done with *cookies.* 10

3. a. Why do *HTTP, FTP, SMTP* and *POP3* run on top of *TCP* rather than on *UDP* ? 4

b. True **or** false ?

i. With *non-persistent connections* between browser and origin server, it is possible for a single *TCP segment* to carry two distinct *HTTP request messages.*

ii. An user requests a *Web page* that consists of some text and two images. For this page, the client will send one *request message* and receive three *response messages.*

iii. Two distinct *Web pages* (for example, www.mit.edu/research.html and www.mit.edu/students.html) can be sent over the same *persistent connection.*

iv. The Date: header in the *HTTP response message* indicates when the object in the response was last modified. 8

c. What is the difference between MAIL FROM: in *SMTP* and From : in the mail message itself ? 8

Or

a. What is an *overlay network* ? Does it include *routers* ? What are the *edges* in the overlay network ? How is the *query-flooding overlay network* created and maintained ? 10

b. *Skype* uses *P2P* techniques for two important functions. What are they ? 4

c. What is a *whois* database ? Discuss why *whois* databases should be made publicly available ? 2+4=6

4. a. Consider a *TCP connection* between Host A and Host B. Suppose that the *TCP segments* traveling from Host A to Host B have *source port number* x and *destination port number* y. What are the *source and destination port numbers* for the *segments* traveling from Host B to Host A ? 2

b. Is it possible for an application to enjoy *reliable data transfer* even when the application runs over *UDP* ? If so, how ? 4

c. Suppose you have the following two bytes : 00110100 and 01101001. What is the *1's complement* for these 2 bytes ? For the bytes noted above, give an example where one bit is flipped in each of the two bytes and yet the *1's complement* does not change? Suppose you have the following two bytes: 11110101 and 00101001. What is the *1's complement* for these 2 bytes ? 6

d. Answer true **or** false to the following statements and briefly justify your answer :

i. The *alternating bit protocol* is the same as the *SR protocol* with a sender and receiver window size of 1.

ii. With *GBN*, it is possible for the sender to receive an *ACK* for a packet that falls outside of its current window.

iii. With the *SR protocol*, it is possible for the sender to receive an *ACK* for a packet that falls outside of its current window.

iv. The *alternating bit protocol* is the same as the *GBN protocol* with a sender and receiver window size of 1. 8

5. a. What are the *two* most important *network layer* functions in a *datagram network* ? What are the *three* most important *network layer* functions in a *virtual-circuit network* ? 4

b. Do *routers* have *IP addresses* ? If so, how many ? 4

c. Suppose an application generates chunks of 40 bytes of data every 20 *msec* and each chunk gets encapsulated in a *TCP segment* and then an *IP datagram*. What percentage of each datagram will be overhead, and what percentage will be application data? 4

d. Compare and contrast *link-state* and *distance-vector routing* algorithms. 8

6. An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The organization needs to have 3 sub-blocks of addresses to use in its three subnets : one sub-block of 10 addresses, one sub-block of 60 addresses and one sub-block of 120 addresses. Design the sub-blocks with first and last addresses, number of unused addresses and the first address of the unused block. 10
