Department of Computer Science and Engineering
Motilal Nehru National Institute of Technology
Midterm Exam, Computer Networks(CS-1503)
BTech (IT) V Semester
Time: 1.5 Hour, MM:20

Note: There are five questions. Attempt all.

1. (5 marks) Consider the following scenario. At a requestor node, R, an application layer process generates requests for data items. These data items are stored at a remote node A. A has an infinite supply of such data items at it always has a data item to send. Nodes R and A are connected to by a channel that can lose or corrupt messages, but will not reorder messages.

   Design a requester protocol that operates at R and A, operating as follows. At R, requests for data items are received from above via a call **request(A)** that requests that the next item be retrieved from A. The request protocol at R eventually delivers a requested data item to the layer above, satisfying such a request, by calling **deliver_data(data)**, where data is a data item received from A. You may assume that a call from above will not be made until the previous call from above requesting a data item has been satisfied via a **deliver_data()** call. R sends request messages to A; the fields in the request message are part of your protocol's design. A send data messages containing a requested data item to R; the fields in the data message are part of your protocol's design.

   (a) Describe the format of messages be ing sent from R to A, and from A to R

   (b) Give a FSM description for the data requesting protocol at R.

   (c) Give a FSM description for the data requesting protocol at A.

2. (4 marks) Assume that in the network shown in Figure.1, two parallel TCP connections are performed. TCP1 connection (between Source A and Sink A) uses TCP Tahoe whereas TCP2 connection (between Source B and Sink B) uses TCP Reno. Initial *ssthresh* for both connection is set to 32. In this specific scenario, no additional delay is introduced. Thus the RTT is only composed of the sums of the delay indicated on each link times two.

   - For the TCP1 transmission, draw the graph of resultant congestion window wrt to time assuming that a packet loss (triple duplicate ACKs) is detected at time 900 ms.
   - For the TCP2 transmission, draw the graph of resultant congestion window wrt to time assuming that a packet loss (triple duplicate ACKs) is detected at time 650 ms.

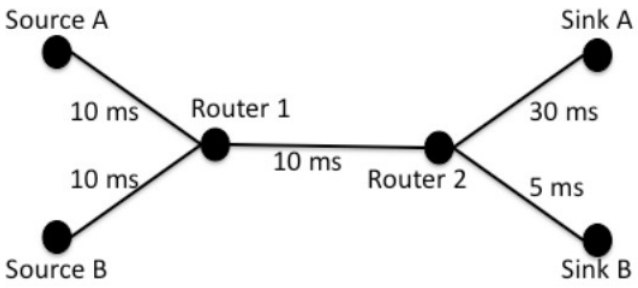

Figure 1: Figure for Question.1

3. (a) (2 marks) Compare GBN and SR in brief. Assume that the timeout values for both protocols are sufficiently long such that 5 consecutive data segments and their corresponding ACKs can be received (if not lost in the channel) by the receiving host (Host B) and the sending host (Host A) respectively. Suppose Host A sends 5 data segments to Host B, and the 2nd segment (sent from A) is lost. In the end, all 5 data segments have been correctly received by Host B. How many segments

has Host A sent in total and how many ACKs has Host B sent in total? What are their sequence numbers? Answer this question for both protocols.

(b) (2 marks) Suppose that s bits are used to represent the sequence number. In class we said that the maximum window size W for Go-Back-N protocol is $W = N - 1$, where $N = 2^s$. The claim is that this is correct only when the packets cannot be re-ordered by the network during the retransmission, i.e., *a packet, P1, sent before another packet, P2, by the sender cannot show up at the receiver later than P2!* Use an example (say, use $s = 2$) to show why $W = N - 1$ will not work correctly if the network can indeed re-order the packets.

4. (4 marks) Assume that any client wants to retrieve the www.timesnow.tv home page but has no information about the www.timesnow.tv web server IP address.

   (a) Describe the process of the client obtaining the IP address for the hostname www.timesnow.tv under the assumption that it is not cached at the local DNS server and that the local DNS server has not cached an entry for the .tv DNS server.

   (b) The www.timesnow.tv is a very popular website and the many client requests cannot be handled by a single server but rather by a cluster of web servers (each having a different IP address). Describe the process that DNS offers for load balancing.

   (c) Give an example for the source and destination port numbers in a TCP segment sent from the client to the www.timesnow.tv web server. Now assume a second browser is opened on the client which also wants to retrieve the www.timesnow.tv start page. What are source and destination port for a TCP packet that belongs to this connection?

   (d) Assume there is an institutional cache in the client's subnet. The client's initial request is cached by this cache. Since news page change frequently the client wants to make sure that it does not get served an outdated HTML page from the cache. Explain the HTTP mechanism that prevents this from happening. Explain with an example containing HTTP requests and responses.

5. (a) (1.5 marks) Machine A runs a web server on port 80 and an FTP server on port 21. Client-1 opens local port 5001 to establish a TCP session to the web server on Machine A. What are the numbes of the destination and source ports in the TCP segments send to the Machine A? Client-2 opens local port 5002 to establish a TCP session to the FTP server on Machine A and opens local port 5001 to establish a TCP session to the web-server on Machine A. What are the numbers of the destination and source ports in the TCP segments send to the Machine A. Would there be any problem in indentifying different connections.

   (b) (1.5 marks) What is the purpose of the HTTP "COOKIE:" field? Are the values in the HTTP message's cookie field stored at the client or server or both? Explain briefly.