CS 421: Computer Networks **SPRING 2012**

MIDTERM
April 3, 2012
120 minutes

Name: _____

Student No: _____

Show all your work very clearly. Partial credits will only be given if you carefully state your answer with a reasonable justification.

Q1	
Q2	
Q3	
TOT	

1)

a) (5 pts) What does it mean that "FTP uses out-of-band control information"?

b) (5 pts) Suppose that we want to change the IP address of firat.bcc.bilkent.edu.tr from 139.179.10.13 to 139.179.20.88. In order to implement this change, we change the corresponding mapping in Bilkent's authoritative name server. Once this mapping is changed in the authoritative name server, will all future references (generated anywhere in the Internet) to firat.bcc.bilkent.edu.tr be sent to 139.179.20.88? Justify your answer.

c) (5 pts) Give two reasons why DNS uses UDP as the transport layer protocol instead of TCP.

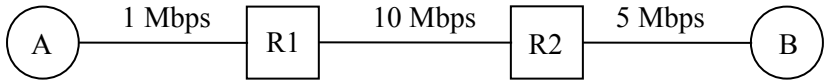
d) (5 pts) Suppose that you want to reliably transfer a file from Host A to Host B. The communication medium between these hosts has an asymmetric nature such that the bit error rate for packets sent from Host A to Host B is negligibly small whereas the bit error rate in the reverse direction, i.e., from Host B to Host A, is substantially higher. Which one of the reliable data transfer protocols, Go-Back-N or Selective Repeat, will you choose? Justify your answer.

e) (5 pts) Consider a TCP server socket which is used for communication between server and client. Is it possible that the data read from this server socket has been sent by more than one client? Justify your answer.

f) (5 pts) Suppose that an application wants all of the functionality provided by UDP. Additionally, the application wants reliable data transfer and flow control, but not congestion control, i.e., application prefers to have only some of the functionalities provided by TCP. How is it possible to provide this different service?

2)

a) (10 pts) Assume that there are 3 links on a path connecting hosts A and B passing through routers R1 and R2 as shown in the following figure. Each link has a distance of 400 km and the transmission rate of each link is shown in the figure. We are transmitting a file composed of **five packets** from node A to node B using datagram packet switching. Each packet has a length of 1250 Bytes including all headers. Assume that the processing and queuing delays in each intermediate node are negligible and the propagation speed is $2x10^5$ km/s. Calculate the total delay incurred in transferring the file from host A to host B.



b) (12 pts) Consider a connection with a **30 msec** roundtrip, delay (including all delays incurred within the network, but excluding the packet transmission time of the sender). We want to transfer a file composed of **18 segments** (with sequence numbers from 1 to 18), where each segment has a transmission time of **1 msec**. Assume that ACK segments have negligibly small size and there is no processing delay at the receiver. Assume also that the processing delay at the sender after an ACK is received is negligible. We assume that the communication between the sender and receiver is full duplex, i.e., sender can send data segments while receiving an ACK segment. **Selective Repeat** protocol is used with a window size of **N = 8** segments. Assume that all data segments are received correctly while the **first transmissions** of the **data segments** with sequence numbers **5** and **11,** and **ACK segment** with acknowledgment number **16** are errored, whereas **all other data** and **ACK segments are fully reliable**. The timeout for each data segment is set to **40 msec starting from the end of the transmission of the segment**. How much time is required to complete the transfer of the whole file and receive the **final ACK** at the sender?

c) (12 pts) Answer the above Question b) when **Go-Back-N** protocol is used with a window size of **N = 8** segments. Each window of the sender has a timeout of **40 msec** starting from the time when the window is set by the sender.

3)

a) (8 pts) Consider the RTT estimation algorithm for setting the retransmission TimeOut used by TCP as we discussed in the class:

$$\text{EstimatedRTT}(k+1) = (1 - \alpha)\,\text{EstimatedRTT}(k) + \alpha\,\text{SampleRTT}(k+1)$$

for k = 1,2,…, where EstimatedRTT(1) = SampleRTT(1). Assume that $\alpha = 1/8$.

RTT of the first segment in its first transmission attempt is 8 msec. The second segment of the TCP connection times out in its first transmission attempt, RTT of this second segment in its second transmission attempt is 20 msec. RTT of the third segment in its first transmission attempt is 24 msec. What value of EstimatedRTT(2) will be generated by the above algorithm?

b) (10 pts) Host A is requesting a file composed of 5 segments, each with a size equal to the maximum segment size (MSS), from host B using HTTP. Assume that the one-way delay between hosts A and B is 50 msec and the transmission time of each data segment is 1 msec, whereas the transmission times of SYN, SYNACK and ACK segments are negligibly small. There are no packet losses during the entire file transfer. Assume that at the beginning of the connection we have ssthresh = 4, and the timeout period is constant at 150 msec. Assume further that the receive window is infinitely large during the entire connection. How long does it take for the file to be transferred from B to A?

c) (10 pts) Redo the above problem now assuming that the file is composed of 18 segments.

d) (8 pts) Three TCP connections are sharing a link with capacity of 100 Mbps (100×10^6 bps). Assume that the bandwidth bottleneck for all three connections is this shared link. The roundtrip times for the connections are 15 msec, 30 msec and 90 msec, respectively. Calculate the average throughputs achieved by the three connections.