Concordia University
Department of Computer Science & Software Engineering

Comp 445, Fall 2013
Instructor: Aiman Hanna
Time: 60 minutes

Mid-term Exam

Keep your answers organized and clean.
This exam has **5** pages. Answer all questions.
Exam will be marked out of 20.

Name:

ID #:

Question 1 (5 marks)

a) Assume a network communication from sender A to receiver B, where multiple possible passes (through various routers) between A and B exist. Further, assume A needs to send a lot of messages to B, where these messages are relatively small in size. Moreover, reliability is required. Under these conditions, is it better to use *message switching*, or *datagram packet switching* for this communication? Explain clearly the reasons behind your choice and indicate the main disadvantages of using the other technique.

b) Now, assume the same communication in question (a) above, with the exception that reliability is no longer required. Will you still choose the same technique you selected in question (a)? If *yes*, indicate why the technique is still better. If *no*, explain why the other technique would now perform better under these new conditions.

Question 2 (3 marks)

a) Infected hosts (i.e. by viruses or worms) can be enrolled by the attackers into a network that is referred to as *botnet*. Explain how these botnet hosts can be used to cause any potential harm either to other networks or to specific servers/devices.

b) Assume a TDM network, with 96 channels, and a bit rate of 6.144 Mbps. Further assume 200ms is needed for end-to-end circuit establishment. How much time is needed to send a file of size 2.88 Mbits over this network?

Question 3 (4 marks)

a) Considering the Internet structure, what is the difference(s) between content provider networks and Tier-1 ISPs? What is meant by Point of Presence (PoP) and Multi-home connections.

b) Assume a host *hst1.bestfrim.org* is attempting connect to *mch8.crm.lawshool.edu*. *Bestfirm.org* maintains a local DNS server *dns.bestfirm.org*. The authoritative DNS server of *lawshool.edu* is *dns. lawshool.edu*. Assume *iterative* DNS quires between the different needed Internet DNS servers. Further, assume that no cache information has previously been kept for the *lawshool.edu* hosts. Describe the sequence of calls between the different machines and DNS hosts until finally the DNS information is resolved. **It is preferable if you provide sketch** (brief drawings) showing these communications and their sequences.

Question 4 (5 marks)

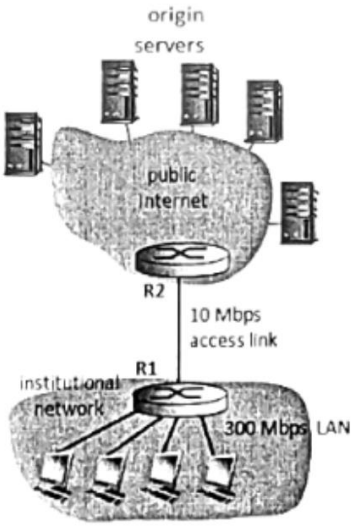
a) As a part of a protocol design team, your colleagues and you were requested to look into the details of the utilized protocol. Since memory is very limited at the receiver side, the protocol is utilizing GBN, and this cannot be replaced by Selective-Repeat. The protocol uses cumulative ACKs and NAKs, as well as timeouts (with pre-set timeout value) to perform what is needed. However, the performance was found to be poor. One of your colleagues recommended the following to enhance the performance: keep the cumulative ACKs and NAKs but reduces the timeout to ½ of the current preset value. You have badly objected this proposal! Explain clearly what the reasons are behind your strong rejection. You must however indicate if the proposal has any validity on in spite of your rejection.

b) A protocol uses checksum for error detection, where it breaks the bits that need to be transmitted into 16-bit chunks, then calculates the checksum. Assume that the following bits need to be transmitted, show clearly what the checksum value is. Also indicate what the sender will actually be transmitting for the checksum verification to be performed by the receiver.

0 0 1 0 0 1 1 1 0 1 1 0 0 1 0 1 0 1 0 1 0 0 0 1 0 1 0 1 1 0

Question 5 (5 marks)

a) Assume the network shown in the figure, where an institutional network has a speed 300Mbps. The hosts on the network are mainly using HTTP, where the average requests from all hosts is 20Mbps. The link between the institution router, R1, and the router connecting it to the Internet, R2, has a rate of 10Mbps. Further, Internet delay (to obtain HTTP objects from the web servers to R2) is 3 seconds. The round trip delay between R1 and R2 is 30 milliseconds when the traffic intensity on the link is below 90%. The delay averages to 6 minutes when traffic intensity exceeds 90%. Finally, the round trip delay between the hosts and R1 is 2 milliseconds. All other delays are negligible.



Under these conditions, what is the total delay needed for the hosts to receive their HTTP requests?

b) Now, assume that the institution installed a local web cache and that in average, 70% of the requests are handled by the cache. Requests from the cache take an average of 1 millisecond. This time is considered negligible for cache misses (if the object is not found in the cache).

Under these conditions, what is the total delay needed for the hosts to receive their HTTP requests?