CS 118 – Fall 2002
Sample Midterm #1

You may use a single 8 ½ x 11 sheet of paper, front and back, with any notes you like. You may also use a calculator.

1. (7) True or False:

   (a) Error control for reliable transfer is implemented only at the link layer.

   (b) In a circuit switched network, after setting up an end-to-end circuit, the transfer time of a file is deterministic, not random.

   (c) UDP is an unreliable datagram protocol because it does not check packets for errors upon arrival, whereas TCP does verify the checksum on incoming packets.

   (d) Reliable data transfer can not be achieved if an unreliable transport protocol such as UDP is used.

   (e) Congestion control is not needed over circuit switched networks.

   (f) The number of entries in the root DNS servers grows linearly with the number of end-systems (hosts) using the Internet.

   (g) Sockets provide the interface between the transport layer and the network layer.

2. (3) For each of the following scenarios, indicate (with an X in the appropriate column) whether it favors packet switching, circuit switching, or neither.

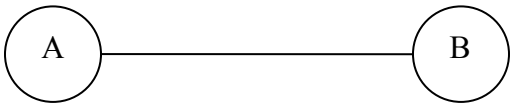
Scenario:	Favors Packet Switching	Favors Circuit Switching	Neither
i. Bursty Data			
ii. Narrow bandwidth relative to user demand for transferring data			
iii. Delay Sensitive Applications			

3. (5) List and briefly describe all of the application and transport layer protocols used to download a webpage.

4. (15) Compare the delay in sending an *x*-bit message over a *k*-hop path (i.e. *k-1* intermediate switches/routers) in a circuit switched network and in a packet switched network. The circuit setup time is *s* seconds. The propagation delay is *d* seconds per hop, the packet size is *p* bits, and the data rate for all links is *b* bps. Under what conditions does the packet switched network have a lower delay?

5. (10) If a DNS resolver at the host *windows.microsoft.com* tries to get the IP address of a non-existing host *nonexist.ucla.edu*, is the local DNS for the zone *microsoft.com* able to inform the DNS resolver that the given host is non-existing? Why or why not? Under what conditions can a given resolver get the IP address of existing host *cheetah.cs.ucla.edu* faster than to get the information about the above-mentioned non-existing host?

6. (30) Given two hosts, connected by a single link:



- The propagation delay of the link is d seconds
- The link bandwidth is R bps
- For each TCP segment, header size is always h bits, payload size is always p bits. If payload sent from application layer is less than p bits, padding bits will be added so that the payload will be exactly p bits.
- TCP window size is fixed at 50
- There is no error or loss in transmission
- The client **A** requests a webpage from **B**, which contains 10 embedded images. Each object is exactly $2p$ bits in size – therefore each object can be sent in exactly 2 packets.
- **A** already holds the IP address for **B** in its local cache

(a) (2) Give an expression (including units) for the Transmission Delay T_{trans} for each packet, including headers. Also derive an expression for the round trip time RTT.

(b) What is the total delay required to view all the contents of the webpage in each of the following scenarios (give answers in terms of T_{trans} and RTT as derived in part a):

i. (7) Using non-persistent parallel HTTP connections (max. 4 parallel connections open at the same time, evenly sharing the bandwidth).

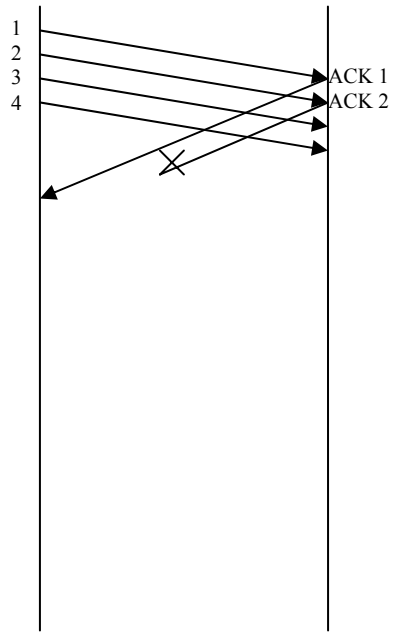
ii. (7) Using persistent HTTP connections with pipelining. Assume that if there are back-to-back HTTP requests, the server will send responses after receiving all HTTP requests.

iii. (7) Using persistent HTTP connections without pipelining.

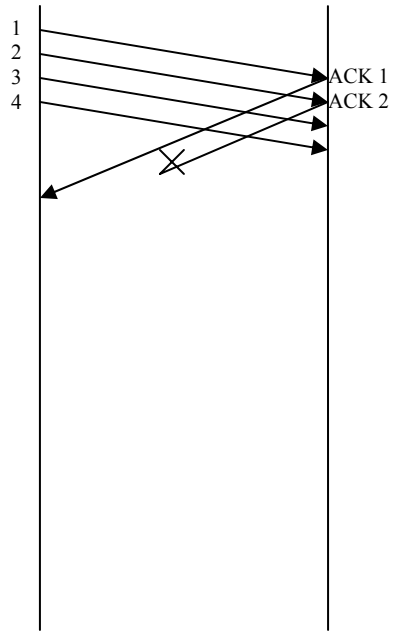
iv. (7) Using non-persistent and no parallel HTTP connections.

7. (10) Fill in the following charts

(a) (5) Assume a Go-Back-N protocol is used with a window size of 4 and that the ACK for packet 2 gets lost. Show the events until packet 2 is acknowledged at the sender side.



(b) (5) Do the same for the Selective Repeat Protocol.



8. (10) A user at host A tries to fetch an HTML file from the HTTP server at host B. The HTTP server listens on its standard port 80. Show the following fields in the first three TCP segments exchanged to set up the connection: source port, destination port, sequence number, acknowledgement number, and flags SYN and ACK. Pick any appropriate initial sequence numbers.

	TCP Source port	TCP Dest. Port	Seq. #	ACK #	SYN	ACK
A to B						
B to A						
A to B						

9. (10) Consider a TCP connection over a wide area network. Assume a malicious router drops every other segment on this connection (i.e. it drops 2, 4, 6, etc.). The TCP version is the Reno version supporting slow start, congestion avoidance, fast re-transmit, and fast recovery. Assume the receiver's advertised window is *awin=256*MSS*. Also, assume that there is plenty of bandwidth available on the path, so as to accommodate a TCP window *cwin = 64* without the malicious drop.

(a) What is the maximum window size achieved on this connection?

(b) Repeat (a) for the case in which the malicious router drops every eighth original packet (i.e. 8, 16, 24, etc.) and no fast retransmit or fast recovery is used.