CSCI 3530  
Computer Networks  
Spring 2006  

Exam 1  

Take home exam handed out on Mar 1, 2006  
Submission deadline: Noon, Mar 8  

Electronic turn-in via project command  
Project name for submission: exam1  
Use the following command to turn in your files in pdf format using the CS unix machines  
project submit 3530s001 exam1 -force <list_of_files>  

Use the following command to view the list of submitted files  
project view 3530s001 exam1  

Solution will be posted on the class website, once the deadline ends.  
Late turnins are non-acceptable.  

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<th>Grading Policy</th>
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<td>Problems 1</td>
<td>20 points</td>
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<td>Problems 2-11</td>
<td>8 points each</td>
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Good luck!
Problem 1

Give a brief definition of the following terms:

a) Communication protocol

b) Client/server model

c) Peer to peer model (P2P)

d) Request For Comments (RFC)

e) Virtual packet switching

f) Finite State Machine (FSM)

g) Port number

h) Socket

i) Transmission delay

j) Propagation delay
Problem 2

(8 points)

Draw a diagram of the Internet Protocol Stack with all the protocol layers and briefly define the functions that each of the layers provides.

Problem 3

(8 points)

Compare and contrast the following switching schemes:

a) Circuit switching
b) Message switching
c) Packet switching
Problem 4

We have studied the basics of HTTP for the retrieval of web pages.

a) Briefly explain the steps necessary for a web browser to request a URL from a remote web server.
b) HTTP version 1.1 is said to use persistent connections. What does that mean?
c) When would a web browser use a conditional GET to request a URL?

Problem 5

Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and suppose the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B.

a) Express the propagation delay, dprop, in terms of m and s.
b) Determine the transmission delay of the packet, dtrans, in terms of L and R.
c) Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.
d) Suppose dprop is greater than dtrans. At time t=dtrans, where is the last bit of the packet?
e) Suppose dprop is less than dtrans. At time t=dtrans, where is the first bit of the packet?
Problem 6 (8 points)

Suppose there are N active peers in a Peer to Peer (P2P) network, and each pair of peers has an active TCP connection. How many nodes and edges are active in the P2P network?

Problem 7 (8 points)

Draw the Finite State Machine (FSM) of a transfer protocol for a completely reliable communication channel. Show the FSM for the sender and the receiver.
Problem 8  (8 points)

Explain how the Go-Back-N can handle each of the following problems:

a) A damaged data frame arrives at the receiver
b) A data frame is lost in transit
c) An acknowledgement is lost
d) A duplicate data frame arrives at the receiver
e) A k-bit sequence number field provides a sequence number range of $2^k$ (i.e., 0..$2^k$-1).

What is the maximum permissible window size?

Problem 9  (8 points)

TCPClient and TCPServer are client and server programs on hosts A and B respectively that use TCP to transmit data between each other. In a similar manner, UDPClient and UDPServer are client and server programs running on hosts B and A respectively, that use UDP to transmit data between each other.

a) Suppose you run TCPClient on host A before you run TCPServer on host B. What happens? Why?
b) Suppose you run UDPClient on host B before you run UDPServer on host A. What happens? Why?
Problem 10  

The congestion window, denoted CongWin, imposes a constraint on the rate at which a TCP sender can send traffic onto the network. The value of Threshold determines the window size at which slow start will end and congestion avoidance will begin. Consider the case when the TCP sender sends a large amount of data and then goes idle at t1. TCP remains idle for a relatively long period of time and then wants to send more data at t2. What are the advantages and disadvantages of having TCP to use the CongWin and Threshold values from t1 when starting to send data at t2? What alternative would you recommend? Why?

Problem 11  

Consider transferring an enormous file of L bytes from host A to host B. Assume the maximum segment size (MSS) of 1460 bytes.

a) What is the maximum value of L such that TCP sequence numbers are not exhausted? Recall that the TCP sequence number field is 4 bytes.

b) For the L you obtain in (a), find how long it takes to transmit the file. Assume that a total of 66 bytes of transport, network and link headers are added to each segment before the resulting packet is sent over a 10 Mbps link. Ignore flow control and congestion control so A can pump out the segments back to back and continuously.