Your Name: _____

CptS/EE 455
Fall 2015
Sample Midterm Exam #1

Write your name on your paper RIGHT NOW!

You may have one 8 1/2 x 11 sheet of notes (both sides, handwritten or typewritten). Computers, phones and other electronics are **not** allowed. You may use a calculator if that is ALL that it is. There are N **questions** with multiple parts on M **pages**. *Please make sure that your copy of the exam is complete before starting.*

Answer **all** the questions in the space provided. This is a **50 minute** exam, 10:10 – 11:00. Exams will be collected promptly at 11:00.

1. (16 points) Terms and Concepts
Explain the following terms in 3 or 4 sentences each:

a) Multiplexing – explain the concept. Give several examples of where multiplexing occurs in networks.

b) If packets are sent from a source host to a destination host over a fixed route, what are the components of the total delay? Which of these components are constant and which are variable?

c) Define *flow control*.

d) Define *congestion control*.

2. (16 points) Host A and Host B are connected by a network that has a bandwidth of 10 megabits/second. The hosts are separated by 3000 kilometers and the network propagation speed is 150,000 kilometers/second. Host A sends 10,000-bit packets to Host B at the rate of 500 packets/second. (Give your answer in the form of a formula that could be entered into a calculator to get the numerical answer, as well as the numerical answer.)

a) What is the **propagation delay** between A and B?

b) What is the **transmission time** of a single packet?

c) If host A is the only host sending traffic on this link, would you expect the queuing delay to be larger or smaller than the maximum of your answers to part a and part b? Why?

d) What happens to your answer to part c if a third host attempts to send the same amount of traffic over the link. That is, the total load on the link is now 1,000 packets/second where each packet is 10,000 bits. Why? (Hint: Consider the traffic intensity on the link)

3. (10 points) Match each statement on the right with the system call on the left that makes it true:

System call	Property
1. bind	____ Tells the operating system whether this socket will be a TCP socket or a UDP socket
2. listen	____ Waits for data to be available for reading
3. connect	____ In a server, establishes the port number at which clients can contact the server
4. socket	____ Returns a new socket descriptor after a client contacts the server
5. accept	____ Cleans up completed per-client server processes in a forking TCP server
6. wait	____ Identifies the host address and port number of a server that a client wishes to communicate with
7. recv	____ Tells the operating system to allow connections to be made to the port associated with a socket

4. (20 points) Protocol layering
a) What is another name for the IP layer? Describe the service model of the IP layer.

b) What protocol layer sits directly above the IP layer? Name two protocols at this layer.

c) What protocol layer sits directly below the IP layer?

d) Name two application layer protocols other than HTTP.

e) The HTTP 1.1 protocol specification added the idea of persistent connections (discussed in Chapter 2). Given what you have learned about TCP connection establishment in Chapter 3, estimate how much time is saved by using a persistent connection (instead of a connection per object) in the following scenario:
The client, C, retrieves a web page from a server, S. The page contains URLs referencing 6 more objects on the same server. The round-trip time between C and S is 250msec.

5. (16 points) For each application state whether TCP or UDP would be a better transport protocol **and why**.

a) File transfer

b) e-mail

c) audio and video for holding a meeting involving two locations

d) Hostname lookups

6. (24 points) Miscellaneous short answer

a) Suppose a TCP sender has a current `EstimatedRTT == 8` seconds and measures `SampleRTT == 4` seconds. What is the new value of `EstimatedRTT`? (The α value applied to the current sample in TCP's estimation algorithm is 1/8). *Show your work.*

b) Suppose a TCP sender sends a segment with `SEQ==100 LEN==120`. Assuming that the receiver has received every segment prior to this one and no segments after this one, what will be the value in the `ACK` field of the segment the receiver sends after receiving this segment?

c) Following receipt of the segment described in part b) above, the receiver next receives a segment with `SEQ==300` and `LEN==80`. What will be the value in the `ACK` field of the segment the receiver next sends (assuming no other segments are received in the meantime)?

d) What can be determined about the SEQ field of segments sent by the receiver from the information given parts b) and c) above?

e) Name the two features that UDP adds to the service model provided by IP.

f) What UDP header fields support these features?