

CS 4254

Homework Assignment 1

Given: September 13, 2004

Due: September 23, 2004

The point value of each problem is shown in []. Each solution must include all calculations and an explanation of why the given solution is correct. In particular, write complete sentences. A correct answer without an explanation is worth no credit. The assignment must be *submitted* as a stapled printout to a box outside the instructor's office by 4:00 PM on September 23, 2004. **No late homework will be accepted.**

Electronic preparation of your solutions is mandatory.

[20] 1. Consider an application that transmits data at a constant rate, say at N bits/second, across a single connection. Also assume that the application runs for long periods of time.

- A. Would a packet switched network be more appropriate than a circuit switched network? Why or why not?
 - B. If the application data rate varied widely, would circuit switching be preferable? Why or why not?
 - C. If the application transferred a constant amount of data over a set of connections $c_1 c_2 \dots c_n$ where n is not constant, which type of switching would be preferable?
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[30] 2. Consider a file of length $M * L$ bits sent over a path consisting of Q links. Each link along the path transmits at R bits/second. The network is lightly loaded, so there are no queuing delays. Also, assume that the propagation delay is negligible and can be ignored. Also assume that a packet switched network is used which splits the file into M packets, each of length L bits. In all cases, there are Q links between the source and the destination.

- A. **Suppose we use a connection oriented network, where the connection setup time is t seconds. Also, suppose that the sending layer adds h bits of header per packet. How long will it take to send the entire file? Give your answer as an equation.**
 - B. **Suppose we use a connectionless network, where the sending layer adds $2h$ bits of header to each packet. How long will it take to transmit the file?**
 - C. **Repeat b. assuming that we are using message switching. $2h$ bits are added to the entire message, i.e. the entire file. How long will it take to transmit the file?**
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[50] **3.** Imagine that you are developing a new p2p filesharing system. Each system acts as both server and client, so for K hosts sharing N files.

- A. Explain how you would plan the system to scale up to the internet. What protocols would you use? How would you set up connections? Who would you connect to when a client first starts up? Would there be encryption?
 - B. Draw a graph showing some nodes connected, with a new node connecting to the network. How many connections does each node need if there are K nodes?
 - C. How would you support multiple file requests from one machine to another?
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