

*Final -- open book section*  
19 December, 1991

The entire exam is to be turned in at 11:55AM. Work the closed book section first and turn it in before you consult your books and notes to work on the open book section. For the closed book section, write your answers on the exam itself.

**Problem 1: (5 points)**

How is the byte 00110001 transmitted using both Manchester encoding and differential Manchester encoding?

**Problem 2: (10 points)**

In most implementations of the sliding window protocol the size of the window can be modified in response to changing network conditions. Generally only the receiver is allowed to modify the size of the window.

By the way, don't bother reading the book's detailed description of the sliding window protocol in answering this question. It won't help. Use your intuition. No math allowed!

Part 2(A): Why is only the receiver allowed to set the window size? What happens if the receiver makes the window far larger than sender can really handle? Can you see any reason why the receiver might even set the window larger than the receiver itself can handle?

Part 2(B): While the receiver may vary the window size, the timeout period is under the control of the transmitter. Why? What happens if the timeout period is too low or too high?

Part 2(C): In practice both hosts play the role of receiver *and* transmitter and, consequently, there are actually two windows. Under what circumstances might it be reasonable for the two windows to be different sizes?

**Problem 3: (8 points)**

The machine `emma.cs.unca.edu` has Ethernet address `AA:00:04:00:0A:C0` and IP address `128.109.185.10`. If `emma` sends a packet to `enka`, which is on the same Ethernet segment, where are `emma`'s addresses included in this packet?

Be precise. (By the way, the index of your textbook starts on page 643.)

**Problem 4: (7 points)***You knew there had to be one...*

Two computers, one on Earth and the other close to Mars, are connected via a microwave radio link that can transmit 1Gbps (1,000,000,000 bits per second). The Mars computer sends packets consisting of images of 10,000,000 bits to Earth.

Part 4(A): *Ignoring the delay*, how long does it take the computer on Mars to transmit the 10,000,000 bit image?

Part 4(B): Let's say the delay encountered in transmitting a signal between Mars and Earth is 100 seconds, how many 10,000,000 bit packets could the Mars computer transmit during the 200 seconds required to get a signal to ``bounce" back from Earth?

Part 4(C): Would you use a sliding window protocol in this situation? Why or why not?

**Problem 5: (15 points)**

I would use many layers of the OSI reference model in printing this exam *if I*

- (1) Write this exam using WordPerfect on my PC clone at home.
- (2) Save the file as a PostScript file on my PC.
- (3) Transmit the PostScript file over the modem line to my workstation at UNCA.
- (4) Transfer the file using the File Transfer Protocol to a computer in the Physics department.
- (5) Print the file on a printer attached to a computer in the Physics department.

List the seven layers of the OSI model and attach to each layer at least one feature of that layer I have used in printing this exam.

**Problem 6: (10 points)**

Every computer scientist should be appalled by fax machines.

How can we permit this crime to taking perfectly good digital files, generated by programs like WordPerfect, Lotus 1-2-3, *etc.*, and printing them in order to send a barely readable copy over a telephone. Why can't these people learn how to use email!

Two reasons are often given for the odd preference many people have for fax.

- (1) Faxes use an addressing format everyone under stands. If you tell Clem your fax number is (704)251-6041, Clem is happy. Clem understands telephone numbers. If you say your email address is brock@cs.unca.edu, Clem isn't happy.
- (2) Faxes can be signed. If I send Clem a purchase order by fax, Clem believes he has a legally binding order. If I send Clem an email message, he calls me up and asks for a fax.

What can we, as computer scientists and networking experts proud of our craft, do to put an end to these two problems (and any others) that allow fax to thrive!