

**Computer Science Department**  
**Stanford University**  
**Comprehensive Examination in Networks**

**Fall 2001**

**READ THIS FIRST!!**

1. You should write your answers for this part of the Comprehensive Examination in a BLUE BOOK. Be sure to write your MAGIC NUMBER on the cover of every blue book you use.
2. **Short, bulleted answers are encouraged.**
3. The total number of points is 60.
4. The exam is CLOSED BOOK. You may NOT use notes, books, computers, other people, etc.
5. Show your work, since PARTIAL CREDIT will be given for incomplete answers.
6. If you need to make an assumption to answer a question, state your assumption(s) as well as your answer.
7. Be sure to provide justification for your answers where reasonable.

### Problem 1 (10 points)

- a. Why do network designers often separate network functionality into different protocol "layers?"
- b. What is the purpose of each of the following Internet protocol stack layers?

Application layer  
Transport layer  
Network layer  
MAC/link layer  
Physical layer

- c. True or False? IPsec or some other security/encryption scheme when used at the network layer makes application-layer security protocols unnecessary.

### Problem 2 (10 points)

What are the advantages and disadvantages of the following two error control mechanisms?

- a. A sliding window of one ("stop and wait")
- b. "Go back N"

### Problem 3 (10 points)

One problem that can occur on telephone lines is echoes. When a signal gets to the destination, some of the energy may be bounced back, causing annoying acoustic echoes.

*Echo suppressors* are devices that detect human speech coming from one direction of the connection and suppress all signals going the other way. When one person stops talking and the other starts, the echo suppressor switches directions. *Echo cancellers* are circuits that analyze the echo, estimate how big it is, and subtract it from the signal delivered without the need for mechanical relays.

What are the advantages of the use of echo cancellers over echo suppressors?

### Problem 4 (10 points)

To initiate a TCP connection, a 3-way handshake is used. The initiator sends a SYN packet, the receiver acknowledges the SYN and the initiator then ACKS that acknowledgement. What problems does this handshake address, with respect to possible loss, reordering, duplication, and delay of packets at the network layer?

**Problem 5 (10 points)**

This problem concerns circuit switching versus packet switching.

For each of the following network characteristics, write "C" if it applies to circuit-switched networks, "P" if it applies to packet-switched networks, or "B" if it applies to both.

- a. uses available bandwidth efficiently
- b. as network load increases, bandwidth for particular conversations decreases
- c. as network load increases, new conversations may fail to be established
- d. handles intermediate router failure gracefully

**Problem 6 (10 points)**

This question concerns UDP.

Which of the following features does UDP provide? (Answer "yes", "no" or "optional" for each one.)

- a. guaranteed delivery
- b. data integrity (checksum)
- c. duplicate protection
- d. multiplexing (source/destination ports)
- e. flow control
- f. reordering protection