

Computer Science Department  
Stanford University  
Comprehensive Examination in Networks

Fall 2000

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. The number of POINTS for each problem indicates how elaborate an answer should be. For example, a question worth 6 points or less doesn't deserve an extremely detailed answer, even if you feel you could expound at length upon it. **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.

### Problem 1 (15 points)

Wireless networks may suffer from interference and poor signal strength, causing packets to drop.

- (3 points) Some wireless link layers will retransmit a dropped packet some finite number of times. What is the advantage to having the link layer perform such a service?
- (6 points) Given such a service at the link layer, what, if any, are the reasons to run TCP over such a network?
- (6 points) Some wireless devices will attempt to retransmit a dropped packet indefinitely (retrying it periodically in the midst of sending other newer packets. Is there any disadvantage to a link layer performing this service rather than leaving all retransmissions up to TCP? If a link layer knew TCP was running on top of it, how might it adapt itself?

### Problem 2 (10 points)

Wireless access to the Internet is growing. These wireless access links, however, are often low-bandwidth. Some network architectures place proxies at the other end (from the user) of a wireless link, so that the proxy can perform “invisible” services on behalf of user to mitigate the effect of the low-bandwidth link. For instance, if a user asks for web pages from a server, the proxy may convert graphics on those pages to low-resolution, smaller, black&white pictures that consume little bandwidth. What issues arise if the data the user requests from the server is encrypted with the user’s key, and what techniques can you come up with to address these issues?

### Problem 3 (20 points)

The Border Gateway Protocol (BGP) is used to route packets between autonomous systems in the Internet.

- (5 minutes) Why is a different routing protocol used between autonomous systems than is used within them? (The issues are not necessarily technical ones.)
- (10 minutes) Instead of maintaining just a cost to each destination, as do most distance vector protocols, each BGP router keeps track of the exact path used. Each BGP router periodically tells its neighbors the exact path it is using to a destination. Why is this exact path information useful to BGP?
- (5 minutes) Why do some autonomous networks decline to carry “transit traffic?” (Transit traffic is traffic that neither originates nor terminates in the autonomous system.)

**Problem 4 (15 points)**

Some wireless networks are unable to provide broadcast service. Does this affect any of the following services in the Internet, and if so, how? What could you do about it?

- a. ARP
- b. DHCP/BOOTP
- c. DNS lookups