

**Computer Science Department
Stanford University
Comprehensive Examination in Networks
99**

November 4, 1999

READ THIS FIRST!

1. You should write your answers for this part of the Comprehensive Examination in a BLUE BOOK. Please use a separate blue book for each problem. Be sure to write your MAGIC NUMBER on the cover of every blue book that you use.
2. This exam is CLOSED BOOK.

1. (15 points total) *End to end.*
 - (a) (5 points) Describe the “end-to-end” argument in networking, given one good example illustrating it.
 - (b) (5 Points) Describe how it has influenced the design of the original Internet protocols, with one specific example.
 - (c) (5 points) Describe how the IP security standard (IPsec) fits into the overall end-to-end story.

2. (15 points total) *Congestion*
 - (a) (6 points) Al Gore, inventor of the Internet, lectured Monica Lewinsky that *congestion collapse* occurs from routers just getting tired from forwarding some many packets. However, even Monica didn't buy that line, or may be she slept through it. Describe what causes congestion collapse in reality, or is it just a fantasy of the liberal-biased media?
 - (b) (6 points) Describe the characteristics and/or limitations that make the Aloha protocol suitable for some radio networks and CSMA-CD suitable for the original Ethernet, and not vice versa, with suitable justification.
 - (c) (3 points) Bill Clinton decides to extend his managed healthcare initiative to cover the “health” of networks by legislating a new link-level flow control (LLFC) mechanism that is supposed to prevent congestion collapse. What are some concerns that the Republicans might legitimately raise about this approach.

3. (15 Points total) *Bandwidth and Delay*
 - (a) (5 points) Suppose I need to move M megabytes of data from San Francisco to New York. One option is leasing a 1.5 Mbps Internet connection; Another is to write the data to 1.5 Megabyte floppy disks and hop on the plane for the 5 hour trip to New York. How big does M have to be for it to be faster to take the plane (stating whatever additional assumptions you need/make)?
 - (b) (4 points) What factors could favor using the lease line over the plane trip, and vice versa, in reality.
 - (c) (6 Points) Some routing experts advocate providing a bandwidth-delay product worth of buffering per port in the router, with delay referring to roundtrip time delay. For example, with 1.5 Mbps links and 25 millisecond round-trip time, the router should have roughly 4.7 kilobytes per port. Are these guys just trying to sell memory or what? Describe the legitimate argument for this amount of memory, if any, and how that relates to the memory required at the end points.

4. (15 Points Total) *Routing*
 - (a) (6 points) Describe how distance vectoring (DV) routing works.

(b) (5 points) Describe the bad behavior that is inherent with DV routing with a specific example, and one solution that have been proposed/used to deal with it.

(c) (4 points) Describe how link-state routing works, in essence, how it avoids the problems of DV routing, and at what costs.

5. (1 Point) Name 3 top networking experts whose first name is David.

The End — I'm clearly out of questions.