

**Stanford University
Computer Science Department**

Fall 2004 Comprehensive Exam in NETWORKS

1. Closed book/ no laptops & notes. Answer in the Blue Book
 2. The exam is timed for one hour.
 3. Write your Magic Number on this sheet & on the Blue Book.
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The following is a statement of the Stanford University Honor Code:

- A. The Honor Code is an undertaking of the students, individually and collectively:*
- 1. that they will not give or receive aid in examinations; that they will not give or receive un-permitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;*
 - 2. that they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.*
- B. The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.*
- C. While the faculty alone has the right and obligation to set academic requirements, the students and faculty will work together to establish optimal conditions for honorable academic work.*

By writing my Magic Number below, I certify that I acknowledge and accept the Honor Code.

Magic Number-----

1. (15 points total) *End to end*
 - (a) (5 points) Define the so-called "end-to-end principle" as applied to the Internet.
 - (b) (5 points) John Kerry claims that putting the transport layer protocol implementation in end systems is an evil corporate plot to drive up the costs and increase the "digital divide". His proposal is having a global coalition of "smart" routers that ensure that applications have reliable communication without having to run a transport protocol. How would you advise the senator before he goes public with this proposal?
 - (c) (5 points) Howard Dean, objecting to TCP as a creation of the US military, claims that it (TCP) violates the end-to-end principle by providing 3-way handshake. Describe whether this is true or false, or a little of both, justifying your answer.
2. (15 points total) *Transport Protocol Design*
 - (a) (8 points) Joe Conservative claims that TCP works well for his applications over the WAN but is inefficient for his LAN applications. Bill Liberal claims that TCP works for his applications over the LAN but is inefficient for his WAN applications. Describe how they can both be right, tying your answer to specific aspects of the TCP design.
 - (b) (7 points) TCP has been improved with selective acknowledgment and fast retransmit. Pick one of these, describe briefly how it works, including a specific scenario in which it helps and one in which it does not help performance.
3. (15 points total) *Congestion Control*
 - (a) (7 points) Larry Roberts, Bob Metcalfe and more recently Simon Lam (all recognized Internet heroes) have warned that the Internet is at risk of "congestion collapse" as a datagram network. Define "congestion collapse" and describe how this can happen, at least in theory, in the Internet.
 - (b) (8 Points) The military becomes concerned about this congestion collapse issue and then is really panicked when they learn that "congestion control is implemented by voluntary actions of endsystem clients", as they describe it to you. Describe what this means, whether it is true and how you would advise them to deal with it, i.e. is there a better alternative approach, refinements or just fine the way it is.
4. (15 points total) *Ethernet*
 - (a) (6 points) Describe each field in the Ethernet header and what properties each field has and why this field is required with those properties, if in fact it is.
 - (b) (5 points) Describe how CSMA-CD works and how this access protocol is affected by the data rate of Ethernet moving from 10 Mbps to support all the way up to 10 Gbps.
 - (c) (4 points) Peterson and Davie say: "it might seem that a wireless protocol would follow the exactly the same CSMA-CD algorithm as Ethernet" as a lead-in to why not. Describe why not and what 802.11 does about it.

The End