SAMPLE Midterm Exam
CMPSCI 290nw: Networked World
Fall 2012
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Instructions:

• There are 4 questions on this exam.
• **Please use two exam blue books** – answer questions 1, 2 in one book, and the remaining two questions in the second blue book.
• Put your name and student number on the exam books NOW!
• The exam is closed book.
• **You have 80 minutes** to complete the exam. **Be a smart exam taker** - if you get stuck on one problem go on to another problem. Also, don't waste your time giving irrelevant (or not requested) details.
• The total number of points for each question is given in parenthesis. There are 100 points total. An approximate amount of time that would be reasonable to spend on each question is also given; if you follow the suggested time guidelines, you should finish with 5 minutes to spare. The exam is 80 minutes long.
• Show all your work. Partial credit is possible for an answer, but only if you show the intermediate steps in obtaining the answer.
• Good luck.
**Question 1: "Quickies"** (27 points (3 each), 20 minutes)

Answer each of the following questions briefly, i.e., in at most a few sentences.

- When packets get “lost” in the Internet on their way from source to destination, where (e.g., a what network component) does this loss usually occur?
- What is a difference between a tier-1 and a tier-3 network?
- What does the traceroute program do?
- What is the purpose of the “Great Firewall of China”?
- What is the purpose of the “If-modified-since” field of an HPPT GET message?
- Name two pieces of information that are contained in an HTTP reply message.
- What is a difference between an authoritative DNS name server and a TLD name server?
- True or False: in a content distribution network, (CDN) when a user makes a request, the content is then downloaded to a CDN site, and served from there to the requesting user.
- What is meant by dynamic adaptive streaming (e.g., as done in Netflix)?

**Question 2: Packet switching versus circuit switching, delays** (25 points, 15 minutes)

Consider the case of $N$ hosts, each of which generates 10 packets per second, on average, to send. Each packet is 1000 bits long. Each node is connected to a router (the same router) via a link with a transmission rate of 100 Kbps (i.e., 100,000 bits per second), as shown to the right. The router in turn is connected to the Internet via a link with a transmission rate of 1 Mbps (i.e., 1,000,000 bits per second).

a) What is the transmission time of a packet on the 100 Kbps link between a host and the router? You can leave your answer in the form of a formula if you want (i.e., you don’t need to do the division or multiplications needed).

b) What is the transmission time of a packet on the link leaving the router? You can leave your answer in the form of a formula if you want.

c) What is the maximum number of hosts ($N$) that can be connected to the router such that the delay on the link leaving the router is not infinite?

d) Suppose that circuit switching was used and each host was allocated 100,000 bits per second of transmission capacity on all links. How many hosts could be accommodated under circuit switching?

e) Could more or less users be accommodated using packet switching? Explain.
**Question 3: ad networks (18points, 15 minutes)**

Suppose a Web ad network, adnetwork.com, places ads on the web pages served by web sites A and B. Draw a diagram showing how the ad network knows that a client (to whom it is delivering an ad to be displayed) knows whether the client has visited website A, B, or both in the past.

**Question 4: Reliable data transfer to two receivers (30 points, 25 minutes)**

Consider a scenario in which Host A wants to simultaneously send packets to Hosts B and C. A is connected to B and C via a broadcast channel—a packet sent by A is carried by the channel to both B and C. Suppose that the broadcast channel connecting A, B, and C has the following properties:

- the channel from A to B and C can *independently* corrupt packets (and so, for example, a packet sent from A might be correctly received by B, but not by C)
- the channel from A to B and C will NOT lose packets (but can corrupt them, as discussed above)
- The channel from B back to A, and from C back to A is *perfect*. That is, a packet sent from B back to A or from C back to A will always be received correctly at A.

Design a stop-and-wait-like error-control protocol for reliably transferring packets from A to B and C, such that A will not get new data from the upper layer until it knows that both B and C have correctly received the current packet:

a) Describe in words the types of messages and the purpose of the messages being sent from A to B and C, and from B and C back to A. What fields are contained in the messages?

b) Briefly describe in words how your protocol at A and your protocol at B works (a few sentences each).

c) Given a timing diagram of how your protocol works when no errors occur, showing correct delivery of the first two messages from A to B and first two messages from A to C.

d) Give a timing of how your protocol works when the first message send from A to B is corrupted but no other messages are corrupted. Showing the correct delivery of the first two messages from A to B and first two messages from A to C.

e) Give a finite state machine description of your protocol for sender A.