Midterm #2
Fall 2001 15-712

Please write your name on the following line:

____

This midterm is open book and open notes.

You should write brief, precise, and legible answers. Rambling brain-dump answers may be punished twice — you run out of time writing them and we run out of patience reading them. :–)

There are eight questions but we will only grade six. (We will also look at the bonus question, but that question does not count towards the six you need to complete.) List the six questions we should grade:

____

Name: ______________________________

1. Hive tries to partition OSes into failure-independent "cells", which is similar to one major benefit (i.e., fault isolation) of processes. Give a concrete example of when Hive cannot fully isolate problems that occur within one cell from affecting other cells.

Name: ____________________________________

2. The "pump" form of thread usage appears in many systems, offering a convenient programming model (simple pipeline elements). It also offers a convenient mechanism for exploiting multiple machines. Explain briefly.

Name: ___________________________________

3. Consider these two approaches to delegating your access privileges to a server. (1) give it your account name and password, so that it can authenticate to a third party as you, (2) give it a capability (e.g., your Kerberos ticket) to act as you. Explain briefly why the second approach is superior. Also, indicate a situation in which it may not work.

Name: ______________________________

4. Many consider anonymity to be a critical component of censorship-resistent publication systems. Identify two roles for anonymity in such systems and what value each each provides.

Name: ______________________________

5. A "Lamport clock" can be used to sort a set of distributed system events into a partial order. Describe a simple way to create a total order from a single Lamport clock and per-machine identifiers.

Name: ____________________________________

6. Consider a storage system of N servers, each containing a replica of the same read-only data. For each scenario below, how many servers (N=?) must there be for client reads to complete successfully in the face of one Byzantine failure? Justify each answer (briefly!).

   - if each server sends its response directly to the client.

   - if the servers must agree on an answer before responding to the client.

Name: ____________________________________

7. To increase security at CMU, some have proposed using fingerprint readers at each building entrace. But, we know that fingerprint checks sometimes fail. To ameliorate this, they are thinking of also using 4-digit PINs. What problem, if any, exists with each of these designs:

   - access will be allowed if either the fingerprint matches or the PIN is known

   - access will be allowed if both the fingerprint matches and the PIN is known

   - access will be allowed if the fingerprint is close and the PIN is known

Name: ____________________________________

8. Consider a transaction processing system in which each ongoing transaction consumes some amount of main memory. If the system begins to experience heavy paging, what could it do to mitigate the problem??

Name: ____________________________________

- (Bonus, 1 point) What super-hero did Timmy dress up as for Halloween??

Name: ____________________________________

- (Bonus, 1 point) What is this cute baby's name?