

CS 574

Final Exam

December 10, 2003

The following exam is open book and open notes. You may feel free to use whatever additional reference material you wish, but **no electronic aids** are allowed. Please note the following instructions. There will be a ten point deduction for failure to comply with them:

- start each problem on a new sheet of paper
- write your social security number, but not your name, on each sheet of paper you turn in
- show your work whenever appropriate. There can be no partial credit unless I see how answers were arrived
- be succinct. You may lose points for facts that, while true, are not relevant to the question at hand

You have until 12:30 to finish the exam. The questions are equally weighted.

1. Suppose we wish to have a system supporting both distributed shared memory and process migration
 - (a) How could we use DSM to simplify copying a process's code and data? Which "style" of virtual memory transfer (monolithic, precopying, or lazy copying, using the terms as defined in the Sprite paper) would this most closely resemble?
 - (b) Would it be most reasonable in this case to use a DSM scheme with fixed homes or one without fixed homes?
 - (c) How could message channels be migrated in a way analogous to the virtual memory?

2. (a) What is the strictest memory consistency model covered in class for which the following is a valid execution history? Why is it not valid in the next stricter model? Insert synchronization operations which will guarantee P3 and P4 "see" the same final values for x and y .

P1	w(x)1	w(y)2				
P2	w(y)1	w(x)2				
P3			r(x)1	r(y)1	r(x)2	r(y)2
P4			r(x)2	r(y)2	r(x)1	r(x)1

- (b) What is the strictest memory consistency model for which the following is a valid execution history? Why could this history never actually happen?

P1	w(x)1		
P2	r(x)1		

3. Using the values $p=3$ and $q=5$, find the smallest possible RSA keys (e, n) and (d, n) such that $d < e$. Use your decryption key to encrypt the message 3. *note: yes, I said "use the decryption key to encrypt" - if you got the keys I'm expecting, this problem will be easy with the decryption key but I wouldn't want to try it by hand with the encryption key*
4. There are four basic memory operations in release consistency: data read, data write, acquire, and release. Which of these should be considered as events in the sense of Lamport's clock paper? Should some of them be considered as events occurring within a process, and some as events occurring between processes? Do any of them have to be combined to be considered as an event?
5. Suppose you have a computer system with a 32 bit virtual address, a 32 bit physical address, and a 4K page size. Also assume the machine has a 64K direct-mapped cache (the line size isn't relevant here), and only 64K of physical memory.
 - (a) If this system uses page coloring, which address bits are "bin" bits?
 - (b) Develop a virtual to physical mapping for the following addresses which will take advantage of page coloring: 1234a123, 17321234, 1234c333, 1234a756, 00122000, ffff0000. Be sure that in your mapping you map pages, not individual addresses.