

# Comprehensive Exam — Systems software

Fall 2007

October 30, 2007

Answer the questions below in your blue book. *You may skip 10 points worth of questions.*

These questions are 5 points each.

1. You are using round robin and run the same job mix on a faster machine but get a non-linear improvement in completion time. What happened?
2. Under memory pressure OS Y's page replacement algorithm reuses clean pages before dirty ones. Why would it do this? What is the downside of doing so?
3. Why might two processes that run correctly with paging deadlock when paging is disabled?
4. Can a first fit allocator ever have less fragmentation than best fit? If not, why not? If so, give an example.
5. Is it possible for a CPU scheduler with a 100 millisecond time slice to spend over half its time in the OS context switch code? Assume context switching takes 1 millisecond. Justify your answer.
6. Explain how reference bits can be emulated on an architecture that has a normal paging system but lacks hardware support for reference bits.
7. Explain why an OS can save less state on a system call trap than a page fault trap.
8. On a system with a TLB what does the OS have to do after revoking a page from a process?

These two questions are 10 points each.

1. Assume the common Unix file system interface, in particular, that you have a way to *non-atomically* write file data, that you have `sync()`, and that `rename` is atomic. Explain how to overwrite a file `A` with new contents such that any crash will result in `A` having either the old or new contents. Give the sequence of calls you would do for this.
2. Describe the optimal spinlock blocking algorithm for a multiprocessor assuming you have perfect knowledge. Give a spin-before-blocking algorithm that will always be within 2x of optimal.