

CS140 Operating Systems and Systems Programming Midterm Exam

February 4th, 2005

(Total time = 50 minutes, Total Points = 50)

Name: (please print) _____

In recognition of and in the spirit of the Stanford University Honor Code, I certify that I will neither give nor receive unpermitted aid on this exam.

Signature: _____

This examination is close notes and close book. You may not collaborate in any manner on this exam. You have 50 minutes to complete the exam. Before starting, please check to make sure that you have all 8 pages.

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Total	

Name: _____

1. (10 points) In class I talked about how semaphores can be used to control the scheduling of a set of threads. The example I gave had three threads (T1,T2,T3) working together to compute $print(f(x,y))$:

```
float x, y, z;
sem   Sx = 0, Sy = 0, Sz = 0;
T1() {
    x = ...;
    V(Sx);
    y = ...;
    V(Sy);
}
T2() {
    P(Sx);
    P(Sy);
    z = f(x,y);
    V(Sz);
}
T3() {
    P(Sz);
    print(z);
}
```

Recode the above code using monitors rather than semaphores. Show the code for routines T1(), T2(), and T3() that use monitors to get the same functionality. Do not simply emulate semaphores with monitors.

2. (10 points) Assume that you have an exponential feedback queue (also called a multi-level feedback queue) that has 8 queues. The highest priority queue has a timeslice of 10 milliseconds. The machine has a CPU that executes 1000 MIPS (million of instructions per second) and a disk that responds in 15 milliseconds. Assume that you have two jobs:

JobA) A large memory job that is thrashing with a page fault occurring every 100 instructions.

JobB) An I/O intensive job that alternates reading a block from the disk and then computing for 25 milliseconds on the block.

a) Describe which queue will contain each job once the system reaches steady state.

b) If you were the owner of JobB, would you prefer the system have a global or local page replacement policy?

Be sure to justify your answer for both parts a) and b).

3. (8 points) Describe the type of code that would cause the linker to encounter each of the following conditions:
 - a) External references to the same symbol in two different object files.
 - b) Global definitions of the same symbol in two different object files.
 - c) A global definition of a symbol that has external references to two different object files.
 - d) A global definition with no external references in any of the object files.

4. (8 points) For each of the memory management hardware schemes below describe if you would expect to find:
- (1) a translation lookaside buffer(TLB)
 - (2) internal fragmentation
 - (3) external fragmentation

The memory management schemes are:

- a) Base and bound.
- b) Segmentation
- c) Paging
- d) Segmentation and Paging.

Be sure to explain your answer.

5. (5 points) Assume that you have some code that detects when a cycle exists in the wait-for graph of a system. Does the presence of a cycle in the wait-for graph signal the presence of a deadlock in the system? Justify your answer.

6. (5 points) Describe the optimal spinlock blocking algorithm assuming that you have perfect future knowledge.

7. (4 points) Is it possible for a CPU scheduler with a 100-millisecond timeslice to spend over half its time in the OS context switch code? Assume that it takes the OS 1 millisecond to context switch the CPU. Justify your answer.