CS140
Operating Systems and Systems Programming

Midterm Exam

July 25th, 2006

Total time = 60 minutes, Total Points = 100

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 exam is closed notes and closed book.

- No collaboration of any kind is permitted.

- You have 60 minutes to complete the exam.

- There are 8 questions totaling 100 points. Some questions have multiple parts. Read all parts before answering!

- Please check that you have all 8 pages.

- Before starting, write your initials on each page, in case they become separated during grading.

- Please print or write legibly.

- Answers may not require all the space provided. **Complete but concise answers are encouraged.**

- SCPD students: If you wish to have the exam returned to you at your company, please check the box.

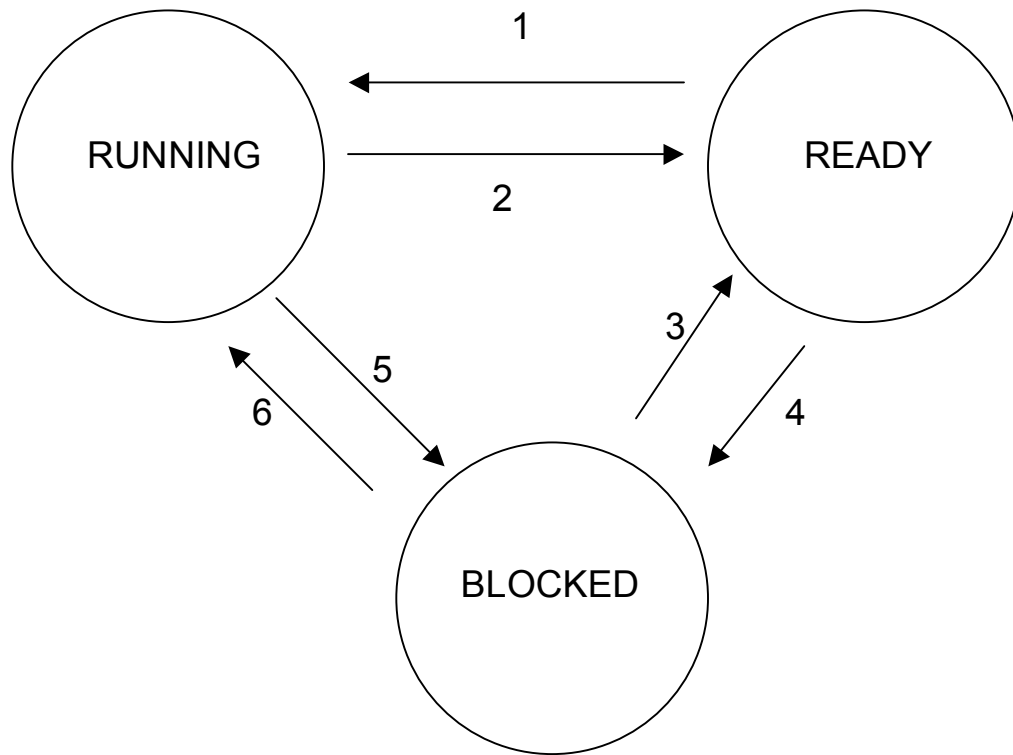|	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

SCPD?	

1. [20] A processor has a 32 bit address space, and combines both segmentation and paging. 4 bits for the segment, 16 for the page, and 12 for the offset. A PTE is 4 bytes. Describe **in detail** what happens in the MMU and OS (use generic terms not the x86 terms) when:

   (a) [10] A user process does a read of address 0xC0DEDBAD and it is in memory.

   (b) [5] What different/more/less happens if it is paged out to disk?

   (c) [5] What different/more/less happens if it is not a valid address?

2. [10] Briefly explaining what conditions cause a thread to move between each of the 3 states, and what causes each arrow. Label it N/A if it doesn't happen.

```
         1
   ┌───────────────┐
RUNNING          READY
   └───────────────┘
         2

   5 ↘       ↗ 3
   6 ↖       ↘ 4

       BLOCKED
```

Arrow 1:

Arrow 2:

Arrow 3:

Arrow 4:

Arrow 5:

Arrow 6:

3. [10] If you have an OS that's designed for a single CPU, and you want to adapt it to a multi-CPU system, describe the types of changes/additions to the software or hardware you would need to make related to the synchronization primitives (locks, etc…) and why. List three.

4. [5] What do semaphores do that condition variables not do, that means you need to be careful how you start the threads?

5. [10] Deadlocks are bad.
   (a) [5] How can you prevent them?

   (b) [5] How can you detect them?

6. [10] A system you admin is thrashing, and the users are mad.
    (a) [5] What are some ways to get into this mess?

    (b) [5] How would you prevent it from happening in YourOS?

7. [20] Linking

(a) [15] Given the following code, list the data segment, text(code) segment, def's and ref's that the linker would create. Assume each line of code is magically 4 bytes, data is also 4 bytes.

```
extern int printf( char * , ... );
extern float func( float );
float foo;
float bar;

float myfunction()
{
  printf( "hello world" );
  foo = func( 1 );
  printf( "foo 1 = %f\n", foo );
  bar = func( foo );
  return( bar );
}
```

(b) [5] If this function was placed in a dynamic shared library, describe how it gets called.

8. [15] Scheduling

    (a) [3] What's good and bad about First Come First Served?

    (b) [3] What's good and bad about Round Robin?

    (c) [3] What's good and bad about STCF?

    (d) [3] What's good and bad about Multi-Level Feedback Queueing?

    (e) [3] What's good and bad about Lottery scheduling?