

Operating Systems
WPI – CS3013
February 5, 20067
Midterm Exam

Name _____

Answer the following **SIX** questions. There's lots of partial credit, so put down what you know. You are to use **NO** notes or papers for this exam.

Problem 1: Short Answers:

a) What is a virtual machine?

b) What is Little's Law? What does it mean?

c) What is the job of a dispatcher?

Problem 2: Scheduling

A number of jobs enter a system with characteristics shown below.

job	arrival time	required processing time
1	0	3
2	1	5
3	3	6
4	6	2
5	7	1

Answer this problem by filling in the Tables.



Determine the **average** residence (or completion) time for these jobs using each of these scheduling mechanisms:

a) FCFS AVERAGE RESIDENCE TIME = _____

Time	Arrival	Start	Finish
0	Job 1	Job 1	
1	Job 2		
3	Job 3		Job 1



b) Shortest job first with preemption.
AVERAGE RESIDENCE TIME = _____

Time	Arrival	Start	Finish

Your Total Score Goes Here

Problem 3: Threads and Processes:

OUTPUT 1:

```
The adder value is = 0
The subtracter value is = 1
The adder value is = 0
The subtracter value is = 1
The adder value is = 0
The subtracter value is = 1
The adder value is = 0
The subtracter value is = 0
The adder value is = 0
The subtracter value is = 0
```

OUTPUT 2:

```
The subtracter value is = -1
The adder value is = 1
The subtracter value is = -2
The adder value is = 2
The subtracter value is = -3
The adder value is = 3
The subtracter value is = -4
The adder value is = 4
The subtracter value is = -5
The adder value is = 5
```

In class we ran a program that, depending on the command line option gave one or the other of the outputs shown here.

What's different about these two environments?

Why do the two executions produce different results?

Problem 4: Critical Section

The following code claims to provide a solution to the critical section problem for two processes. Explain how the code **does** or **does not** meet the **THREE** requirements for a critical section.

```
Shared Boolean Flag[2];           // Initially Flag[0] and Flag[1] = FALSE;
                                   // When flag == TRUE, it indicates a user wants to
                                   // get into the critical section.

For Process 0:
while( TRUE )
{
    Flag[0] := true;
    while ( flag[1] ) ;
    // critical section
    flag [0] = false;
    remainder section
}

For Process 1:
while( TRUE )
{
    flag[1] := true;
    while (flag[0]);
    // critical section
    flag [1] = false;
    remainder section
}
```

Does this code satisfy the THREE criteria for a critical section?? Explain why or why not.

Problem 5: Scheduling

General purpose operating systems handle a mix of processes using short and long amounts of CPU.

- (a) What is the difference between a long and short process in terms of process scheduling? Give an example of each type of process.

- (b) Describe how the Linux credit-based process scheduling policy accounts for both short and long processes.

Problem 6: The Big Picture:

On the following page, you see an overview schematic of how an operating system is constructed in order to perform system calls and scheduling.

On that picture are a number of boxes. These boxes actually correspond to the picture I showed in class. I don't expect you to remember the exact names I used for the functions, but please write a brief statement of the tasks that need to occur in each box in order to accomplish a disk read. Plan your answers so that you provide an overview of the operations that must occur to do the disk read. HINT: The functions are lettered in approximate chronological order.

Function A:

Function B:

Function C:

Function D:

Function E:

Function F

Function G

Queue a:

Queue b: