UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering
and Computer Sciences
Computer Science Division

CS 162, Fall, 2001 Prof. Alan Jay Smith

Midterm 1, October 8, 2001
Part I

You have until the time announced for this exam. The exam is **closed book and closed notes.** All answers should be written on the exam paper. Anything that we can't read or understand won't get credit. Any question for which you give *no answer at all will receive 25% partial credit*. Please answer in standard English; illiterate or illegible answers to essay questions will lose credit. If we can't understand your answer, it is wrong. Partial credit will be given for "computation-type" problems only if your errors are obvious to the grader; we are not going to spend significant time debugging your solution. If necessary, you may continue on the back of a page. Please watch the front board for corrections and other information. This exam has 7 questions on 7 pages and is in two parts. Answers may be continued on the back of a page.

Name (**last**, first, middle):_____________________________________

Student ID #________________________ Code #____________________

Class Account:___________________________________

1. The discussion of a hashed (inverted) page table indicated that the size of the table was proportional to the size of main memory. Why? Do you also need a regular page table? Why? How large is the regular page table? (12)

Name (last, first, middle):______________________________________

2. List and explain as many tradeoffs as you can between writing a program using: (a) one process, (b) multiple processes, and (c) one process with threads, to solve a problem. (12)

Name (last, first, middle):_______________________________________

3. Suppose that you want to write to a location in memory, and you have a page fault. List and explain all of the steps that have to be taken in order to make that memory reference. Your answer should mention all of the following: disk, page table, TLB, translator, scheduler, page table entry, etc. ("etc." means that there are other things you also need to mention.) (16)

Name (last, first, middle):______________________________________

4. You have processes 1...4 with arrival times and CPU processing requirements as shown. For each of the following scheduling algorithms, show (in a table or diagram) at each time which process is running on the CPU. Compute the average flow time over this set of jobs. You may assume that there are no overhead costs. (16)

Process	Arrives	CPU time
1	0	3
2	2.1	1
3	3.2	5
4	4.3	2

a) RR (quantum = 0.5)
b) SRPT
c) SJF
d) SET (quantum = 0.5)

Name (last, first, middle):______________________________________

5. For the following two cases, please either show a complete safe sequence or prove that there isn't one (12):

Process	has-X	has-Y	max-needs-X	max-needs-Y
A	10	20	75	50
B	0	70	50	90
C	30	10	60	40
D	50	80	100	220

(a) available: X: 40 Y: 40

(b) available: X: 40 Y: 35

Name (last, first, middle):______________________________________

6. The following algorithm, developed by Dekker, is the first known correct software solution to the critical section problem for two processes. The two processes, P0 and P1, share the following variables:

```
var flag: array [0..1] of boolean; (*initially false*)
    turn: 0..1;
```

The following program is for process Pi (i=0 or 1), with Pj (j=0 or 1) being the other process:

```
repeat
   flag[i]:=true;
   while flag[j]
      do if turn = j
         then begin
            flag[i]:=false;
            while turn=j do noop;
            flag[i]:=true;
         end;
   ...
   critical section
   ...
   turn:=j;
   flag[i]:=false;
   ...
   remainder section
   ...
until false;
```

Prove that the algorithm satisfies all three requirements (mutual exclusion, progress, bounded waiting) for the critical section problem. (16)

Name (last, first, middle):____

7. Explain what an open (queuing) system is and what a closed system is. Does the scheduling algorithm affect the throughput in a closed system? In an open system? Does it affect the flow time in a closed system? In an open system? Please explain your answers. (16)