CS 376	**Operating Systems**	Test 2
Name:	Winter 1998	Max Pts: 49

Important: This is an open book test. You can use any books, notes, or paper. *Do not log into the computer during the test.* Any calculations and rough work can be done on the back side of the test pages. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem. You will lose five points for not writing your name.

1. [10 pt] Consider the following set of processes:

Process Name	Arrival Time	Processing Time
p_0	0	3
p_1	1	1
p_2	3	2
p_3	9	9
p_4	12	5

Calculate the average wait time and average turnaround time for the following algorithms:

(a) First come first served

(b) Last in first out

(c) Round robin (quantum = 2)

(d) Shortest job next

(e) Shortest remaining time next

2. [5 pt] What type of process is generally favored by a multilevel feedback queuing scheduler – a CPU-bound process or an I/O-bound process? Briefly explain why?

3. [15pt] Consider the following snapshot of a system. There are no current outstanding queued unsatisfied requests.

Process	Current allocation				Maximum demand				Available			
	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4
p_0	0	0	1	2	0	0	1	2	2	1	0	0
p_1	2	0	0	0	2	7	5	0				
p_2	0	0	3	4	6	6	5	6				
p_3	2	3	5	4	4	3	5	6				
p_4	0	3	3	2	0	6	5	2				

(a) Compute the *Need matrix.*

(b) Is the system currently in a safe state or unsafe state? Why?

(c) Which processes, if any, are or may become deadlocked?

(d) If a request from p_2 arrives for (0, 1, 0, 0), can that request be granted immediately? In what state (deadlocked, safe, unsafe) would immediately granting that request leave the system? Which processes, if any, are or may become deadlocked if this whole request is granted immediately?

4. [9 pt] To implement the various placement algorithms for dynamic memory partition, a list of the free blocks of memory must be kept. For each of the three methods (best fit, first fit, and worst fit), what is the average length of the search? Answer this using the Big-Oh notation. In each method, can we improve the search by modifying the list structure (e.g., by sorting the list)?

5. [10 pt] Suppose the page table for the process currently executing on the processor looks like the following. All numbers are decimal, everything is numbered starting from zero, and all addresses are memory byte addresses. The page size is 1,024 bytes.

Virtual page number	Valid bit	Page frame number
0	1	4
1	1	7
2	0	1
3	1	2
4	0	0
5	1	0

(a) Describe exactly, how, in general, a virtual address generated by the CPU is translated into a physical main memory address.

(b) What physical address, if any, would each of the following virtual addresses correspond to? (Do not try to handle any page faults, if any).

i. 1052

ii. 2221

iii. 5499