CS 4760	**Operating Systems**	**Test 2**
Name:	Fall 2021	Max Pts: 68

Important: This is an open book test. You can use any books, notes, or paper. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem.

1. [6 pt] What is the distinction between competing processes and cooperating processes? Illustrate with an example of each.
2. [6 pt] What is a spin lock? Why does Linux prefer spin lock to semaphore to update some kernel data structures?
3. [6 pt] Why does a standard implementation of Linux limit the maximum PID number to 32767?
4. [6 pt] n processes are time-sharing the CPU using round-robin scheduling on a single CPU machine. Each of them requires T ms of CPU time to complete. What is the average turnaround time for the processes if they all arrived at the same time? Assume that the context switching overhead is zero.
5. [6 pt] What is the difference between deadlock detection, prevention, and avoidance?
6. [10 pt] Consider a system with a total of 256 units of memory allocated to three processes as shown:

Process	Max	Current Alloc
p_0	219	17
p_1	109	104
p_2	65	63

   Apply the Banker's algorithm to determine whether it would be safe to grant each of the following requests. If yes, indicate a sequence of terminations that could be guaranteed possible. If no, show the reduction of the resulting allocation table.

   (a) A fourth process arrives, with a maximum memory need of 125 and an initial need of 42 units.
   (b) A fourth process arrives, with a maximum memory need of 135 and an initial need of 111 units.

7. [6 pt] Is a knot in the process-resource graph necessary for a deadlock to occur? Is it sufficient?
8. [6 pt] What is the difference between `.com` and `.exe` files in the DOS/Windows environment?
9. [15 pt] You have a physical memory of 128MB, starting at address 0. Your operating system requires at least 32MB all the time. Consider the arrival of processes as follows:

Process	Burst time	Arrival time	Memory needed
p_0	2	0	92MB
p_1	18	1	7MB
p_2	4	4	51MB
p_3	4	7	48MB
p_4	16	8	46MB
p_5	5	8	10MB
p_6	2	12	75MB
p_7	17	13	59MB

Show the layout of memory, using first-fit algorithm, at times 10, 20, 30, 40, and 50.