CMP 426/697 FINAL EXAM
Fall 2018

NAME: _____

Question	**Grade**
1	
2	
3	
4	
Total	

1. **[35 Points] Process Management**

A). (10 points) Draw the state diagram of a process from its creation to termination, including all transitions, and briefly elaborate every state and every transition.

B). Deadlocks: Consider the following snapshot of a system (P=Process, R=Resource):

	Maximum				Allocation				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	3	2	1	4	1	0	1	1	8	5	9	7
P1	0	2	5	2	0	1	2	1				
P2	5	1	0	5	4	0	0	3				
P3	1	5	3	0	1	2	1	0				
P4	3	0	3	3	1	0	3	0				

Answer the following questions using banker's algorithm:

i. (4 points) Calculate the *Needs* matrix:

ii. (6 points) Is the system in a safe state? If so, show a safe execution sequence in which the processes can run

C). (10 points) In lecture, we said that, if the semaphore operations **Wait and Signal are not executed atomically**, then mutual exclusion may be violated. Assume that Wait and Signal are implemented as below:

```
void Wait (Semaphore S) {
        while (S.count <= 0) {}
        S.count = S.count - 1;
}

void Signal (Semaphore S) {
        S.count = S.count + 1;
}
```

Describe a scenario of context switches where two threads, T1 and T2, can both enter a critical section guarded by a single mutex semaphore as a result of a lack of atomicity.

D). (5 points) Given the following set of processes, draw the Gantt chart for Priority scheduling. Be sure and state any assumptions you make in your solution. Calculate the average wait time for your solution

Process	Burst	Arrival	Priority
P1	5	2	1
P2	1	3	2
P3	8	3	3
P4	5	1	2
P5	6	4	4

2. (30 points) Memory Management

A. (5 points) Memory management is important in operating systems. Briefly, discuss the main problems that can occur if memory is managed poorly.

B. (10 points) Name and describe any two-page replacement algorithms.

C. (6 points) What is a translation look-aside buffer? What is contained in each entry it contains?

D. (5 points) What is thrashing? How might it be detected? How might one recover from it once detected?

E. (4 points) Explain the difference between logical and physical addresses

3. [25 points] Storage management

Disk Scheduling

A. Disk requests come into the disk driver for cylinders 10, 22, 20, 2, 40, 6, and 38, in that order. Assume that the disk has 100 cylinders numbered 0 through 99. The arm (head) is initially at cylinder 20.

Based on the following disk scheduling algorithms, draw scheduling diagram indicating the movement of the head as arm (head) moves around the cylinders services the requests.

i. (5 points) First-come, First-served(FCFS)

ii. (5 points) Shortest Seek Time First (SSTF)

iii. (5 points) SCAN (with the disk-arm initially moving towards higher number cylinders from lower number cylinders)

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B. (10 points) What are the five major activities of an operating system in regard to file management?

4. Answer the following questions

A). Explain the use of fork() and vfork() system calls