CS 692 Capstone Exam Systems Fall 2018: Choose any 2 of the 3 problems.

1) Consider a system with 3 resources (A, B, C) in quantity (7, 6, 7). The Banker's Algorithm is used to allocate resources and it has the following SAFE state:

Process	Allocation			Max			Need			Available:	A	B	C
	A	B	C	A	B	C	A	B	C		3	2	1
P0	1	0	2	2	1	6	1	1	4				
P1	0	1	0	2	2	1	2	1	1				
P2	3	1	2	6	6	5	3	5	3				
P3	0	2	2	0	5	3	0	3	1				

a) Justify why the current state is safe.
b) If P0 requests an additional unit of resource B, will it be allowed? Justify your answer.

2) Consider two CPU scheduling algorithms for a single CPU: Preemptive Shortest-Job-First (also known as Shortest Remaining Time First) and Round-Robin. Assume that no time is lost during context switching. Given four processes with arrival times and expected CPU time as listed below, draw a Gantt chart to show when each process executes using

a) Round-Robin with a time quantum of 4.
b) Preemptive Shortest-Job-First (Shortest Remaining Time First).
For part b) only, calculate the average turnaround time.

Process	Arrival Time	Expected CPU Time
P1	0	7
P2	3	9
P3	5	6
P4	9	3

3) There are 3 standard goals to the 2-process mutual exclusion problem:
Goal 1: Mutual exclusion is guaranteed
Goal 2: Deadlock cannot occur.
Goal 3: Indefinite postponement cannot occur.

Attempted Solution: common variables: flag1, flag2 (both initially false)

Process 1

```
while (true) {
  while (flag2); //empty body
  flag1 = true;
  Critical section;
  flag1 = false;
  Noncritical section;
}
```

Process 2

```
while (true) {
  flag2 = true;
  while (flag1); //empty body
  Critical section;
  flag2 = false;
  Noncritical section;
}
```

For the above solution,
a) Select one goal that is not satisfied and provide an execution sequence that violates the goal.
b) Select one goal that is satisfied and give a brief explanation that justifies why the goal is met for all possible execution sequences.