CSE 421/521 – Quiz 2 Solution
(Fall 2014)

Question 4 (15pts): Consider a system with 5 processes and 4 resources. The state is given by *Allocation* (current allocation matrix), *Max* (maximum resources needed matrix), and *Available* (vector of free resources).

	Allocation A B C D	Max A B C D	Available A B C D
P1	0 0 1 2	0 0 1 2	1 5 2 0
P2	1 0 0 0	1 7 5 0	
P3	1 3 5 4	2 3 5 6	
P4	0 6 3 2	0 6 5 2	
P5	0 0 1 4	0 6 5 6	

(a) (10 pts) Is the system in a safe state? Show using the Banker's Algorithm (by showing the state of the need matrix at t=0, and the state of the work vector at the every step of the algorithm.) If there is a safe sequence, show it.

Need A B C D	Work A B C D	Safe Sequence?
0 0 0 0	1 5 2 0	**YES:** < P1, P3, P4, P5, P2 >
0 7 5 0	1 5 3 2	
1 0 0 2	2 8 8 6	
0 0 2 0	2 14 11 8	
0 6 4 2	2 14 12 12	
	3 14 12 12	

* PS: There can be other possible safe sequences such as : <P1, P3, P2, P4, P5> which is also correct.

(b) (15 pts) If process 2 makes a request for (0 4 2 0) can it be granted? Show using the Banker's Algorithm as in part (a).

If this allocation is made, the Available vector becomes <1 1 0 0 > and the Allocation vector for P2 becomes <1 4 2 0>. With these changes, we run the Banker's algorithm again to see if it leads to a safe sequence.

Need A B C D	Work A B C D	Safe Sequence?
0 0 0 0	1 1 0 0	**YES:** < P1, P3, P4, P5, P2 >
0 3 3 0	1 1 1 2	
1 0 0 2	2 4 6 6	
0 0 2 0	2 10 9 8	
0 6 4 2	2 10 10 12	
	3 14 12 12	

Since allocation of these resources leaves the system still in a SAFE state, we can grant this allocation. (* PS: There can be other possible safe sequences such as : <P1, P3, P2, P4, P5> which is also correct.)