CS307 Operating System Exercises Spring 2020

Exercise 3: Deadlocks

Due Time: 12:30PM Apr. 9, 2019

1. A computer system has 8 printers that are shared by K process. Each of the processes can take no more than 3 printers.
   a. What is the minimum value of K that may cause the system deadlock? Why?
   b. Is there a minimum value of K that must cause the system deadlock? Why?

2. Consider the following snapshot of a system:

	Allocation				Max				Available			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P0	0	0	1	2	0	0	1	2	2	1	0	0
P1	2	0	0	0	2	7	5	0				
P2	0	0	3	4	6	6	5	6				
P3	2	3	5	4	4	3	5	6				
P4	0	3	3	2	0	6	5	2				

   Answer the following questions using the banker's algorithm:
   a. What is the content of the matrix Need?
   b. Is the system in a safe state? Why or why not?
   c. If a request from process P2 arrives for (0,2,0,0), can the request be granted immediately? Briefly Explain.

3. Consider a system with four processes P1, P2, P3, and P4, and two kinds of resources, R1, and R2, respectively. Each kind of resource has two instances. Furthermore:
   - P1 is allocated with an instance of R2, and requests an instance of R1.
   - P2 is allocated with an instance of R1, but doesn't need any more resource.
   - P3 is allocated with an instance of R1, and requests an instance of R2.
   - P4 is allocated with an instance of R2, but doesn't need any more resource

   a. Draw the resource allocation graph.
   b. Is there a cycle in the graph? If yes name it.
   c. Is the system in deadlock? If yes, explain why. If not, give a possible sequence of executions after which every process completes.

4. A system has four processes and five allocable resources. The current allocation and maximum needs are as follows:

	Allocated	Maximum	Available
Process A	1 0 2 1 1	1 1 2 1 3	0 0 1 X 2
Process B	2 0 1 1 0	2 2 2 1 0	
Process C	1 1 0 1 0	2 1 3 1 0	
Process D	1 1 1 1 0	1 1 2 2 1	

What is the smallest value of X for which this is a safe state?