Chapter 8 – Deadlocks

1. Consider the following snapshot of a system:

	Allocation	***Max***	***Available***
	A B C D	*A B C D*	*A B C D*
*P*0	2 0 0 1	4 2 1 2	3 3 2 1
*P*1	3 1 2 1	5 2 5 2	
*P*2	2 1 0 3	2 3 1 6	
*P*3	1 3 1 2	1 4 2 4	
*P*4	1 4 3 2	3 6 6 5	

   Answer the following questions using the banker's algorithm:
   a. Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.
   b. If a request from process *P*1 arrives for (1, 1, 0, 0), can the request be granted immediately?
   c. If a request from process *P*4 arrives for (0, 0, 2, 0), can the request be granted immediately?

2. Which of the following are physical resources? Which of the following are logical resources?
   a. CPU cycles
   b. Printers
   c. Files
   d. Tape drives
   e. Mutex locks
   f. Memory space
   g. Semaphores

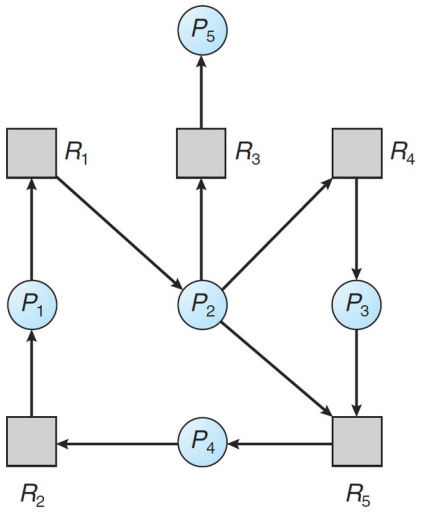
3. Processes may utilize a resource in the sequence Request, Use, and Release. Write the system calls for Request and Release for each of the following resources:

   a. Device
   b. File
   c. Memory
   d. Semaphore
   e. Mutex lock

4. What are the four necessary conditions that need to hold simultaneously for a deadlock situation in a system?

5. For a deadlock to occur, each of the four necessary conditions must hold. By ensuring that at least one of these conditions cannot hold, we can prevent the occurrence of a deadlock. Which one condition must hold and cannot be applied for deadlock prevention?

6. Assume there are three resources, R1, R2, and R3,that are each assigned unique integer values 15, 10, and 25, respectively. What is a resource ordering which prevents a circular wait?
7. Figure shows a resource-allocation graph.
    a. Draw the corresponding wait-for graph.
    b. How do we detect a deadlock in a wait-for graph?



8. A resource-allocation graph is shown in Figure (a).
    a. Is the system deadlocked? Why or why not?

    Suppose that process P3 requests an instance of resource type R2. We add a request edge P3→ R2 to the graph as shown Figure (b).

    b. Is the system deadlocked? Why or why not?