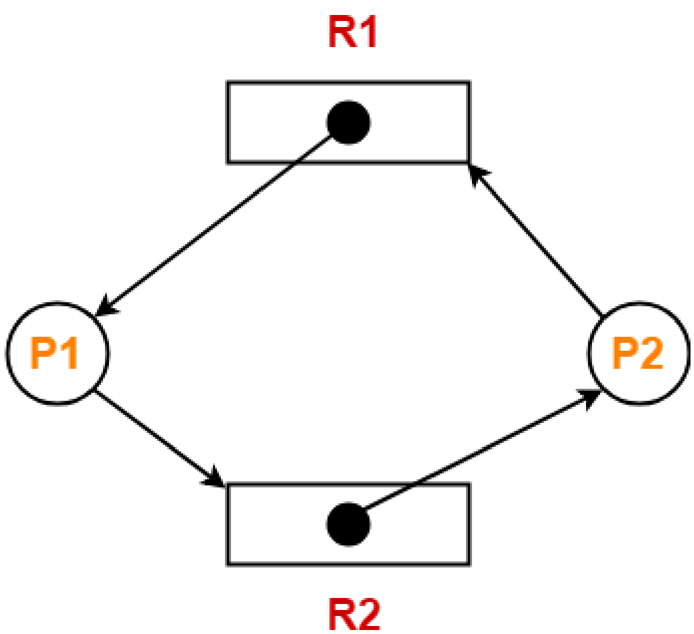
Problem-01:

Consider the resource allocation graph in the figure-



Find if the system is in a deadlock state otherwise find a safe sequence.

Solution-

Method-01:

- The given resource allocation graph is single instance with a cycle contained in it.
- Thus, the system is definitely in a deadlock state.

Method-02:

Using the given resource allocation graph, we have-

	Allocation		Need	
	R1	**R2**	**R1**	**R2**
Process P1	1	0	0	1
Process P2	0	1	1	0

Available = [R1 R2] = [0 0]

Now,

- There are no instances available currently and both the processes require a resource to execute.
- Therefore, none of the process can be executed and both keeps waiting infinitely.
- Thus, the system is in a deadlock state.

Step-01:

- Since process P3 does not need any resource, so it executes.
- After execution, process P3 release its resources.

Then,

Available

= [0 0] + [0 1]

= [0 1]

Step-02:

- With the instances available currently, only the requirement of the process P1 can be satisfied.

- So, process P1 is allocated the requested resources.
- It completes its execution and then free up the instances of resources held by it.

Then-

Available

= [0 1] + [1 0]

= [1 1]

Step-03:

- With the instances available currently, the requirement of the process P2 can be satisfied.
- So, process P2 is allocated the requested resources.
- It completes its execution and then free up the instances of resources held by it.

Then-

Available

= [1 1] + [0 1]

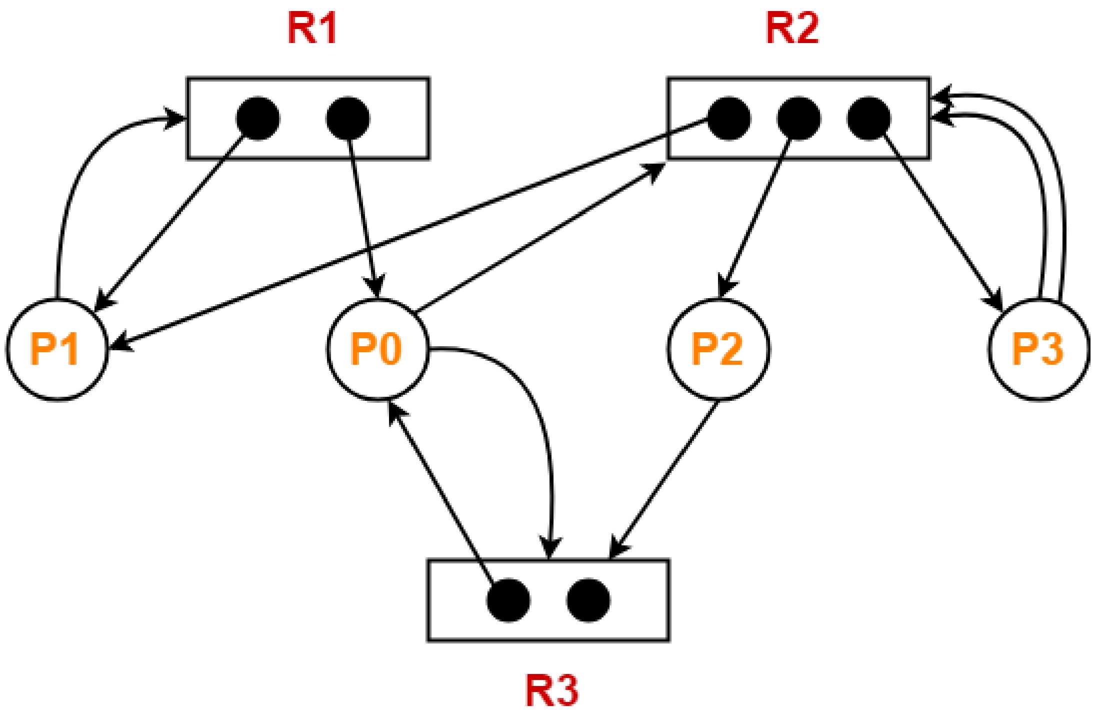
= [1 2]

Thus,

- There exists a safe sequence P3, P1, P2 in which all the processes can be executed.
- So, the system is in a safe state.

Problem-03:

Consider the resource allocation graph in the figure-



Find if the system is in a deadlock state otherwise find a safe sequence.

Solution-

- The given resource allocation graph is multi instance with a cycle contained in it.
- So, the system may or may not be in a deadlock state.

Using the given resource allocation graph, we have-

	Allocation	Need

	R1	R2	R3	R1	R2	R3
Process P0	1	0	1	0	1	1
Process P1	1	1	0	1	0	0
Process P2	0	1	0	0	0	1
Process P3	0	1	0	0	2	0

Available = [R1 R2 R3] = [0 0 1]

Step-01:

- With the instances available currently, only the requirement of the process P2 can be satisfied.
- So, process P2 is allocated the requested resources.
- It completes its execution and then free up the instances of resources held by it.

Then-

Available

= [0 0 1] + [0 1 0]

= [0 1 1]

Step-02:

- With the instances available currently, only the requirement of the process P0 can be satisfied.
- So, process P0 is allocated the requested resources.
- It completes its execution and then free up the instances of resources held by it.

Then-

Available

= [0 1 1] + [1 0 1]

= [1 1 2]

Step-03:

- With the instances available currently, only the requirement of the process P1 can be satisfied.
- So, process P1 is allocated the requested resources.
- It completes its execution and then free up the instances of resources held by it.

Then-

Available

= [1 1 2] + [1 1 0]

= [2 2 2]

Step-04:

- With the instances available currently, the requirement of the process P3 can be satisfied.
- So, process P3 is allocated the requested resources.
- It completes its execution and then free up the instances of resources held by it.

Then-

Available

= [2 2 2] + [0 1 0]

= [2 3 2]