03·03·2020
TUESDAY

Assignment No. 2

Q1. Write a short note on Process Synchronization [CO3]

Q2. What is Mutual exclusion? Give software approaches for mutual exclusion.[CO3]

Q3. Write a short note on Resource Allocation Graph (RAG) [CO4]

Q4: What is deadlock? Explain various deadlock prevention techniques. [CO4]

Q5: Consider the following Snapshot of a System.[CO4]

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

Answer the following questions using Banker's Algorithm:

1. What is the content of need matrix?
2. Is the system in a safe state.

Q1.

Ans:

① Each process executes its own operations on shared variables sequentially, as specified by its own program. Nevertheless, different processes may execute their operations on the same shared variable concurrently. i.e. Operation execution of different processes may overlap, and they may affect one another.

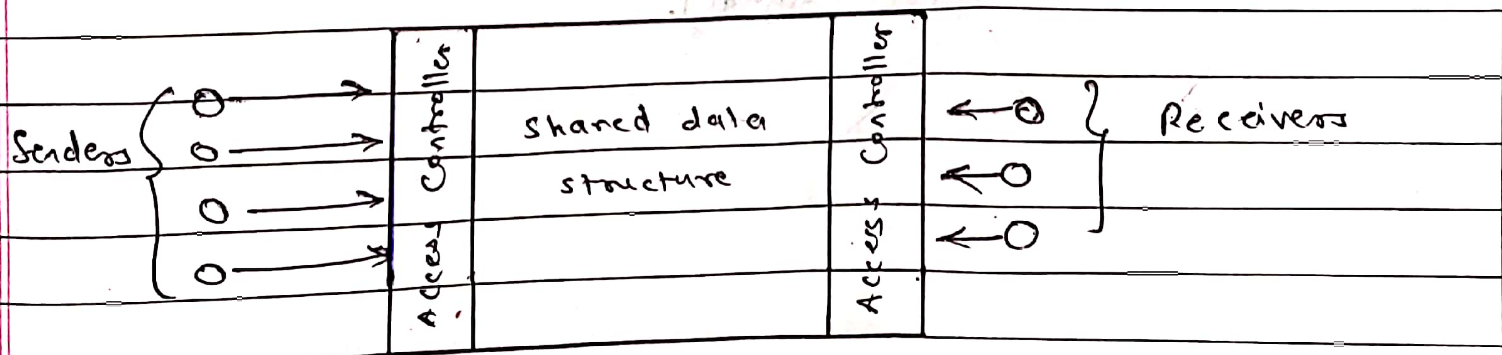
② Each operation on a shared variable, when executed indivisibaly, transforms the variable from one consistent value to another. However, when operations are executed concurrently on a shared variable, the consistency of its value may not the guarented.

③ The behaviours of operation executions on shared variables must be predictable for effective interprocess communication

④ Thus, operation execution on shared variables may need to be coordinated to ensure their consistency semantics

⑤ Coordination of access to shared variables is called synchronization.

⑥ A synchronization solution coordinate accesses from process to shared variables, Where all accesses to shared variables are chaneleled through access controllers



Q2.

Ans:

Mutual Exclusion

1. It is a mechanism to avoid data inconsistency
2. It ensures that only one process is doing certain things at one time.
3. Used to solve critical section problems
4. It is one of the condition for deadlock to occur.
5. It is a property to concurrency control
6. It must be holding true for non shareable resources
7. Non shareable resources includes, printer, memory space, etc.

Software Approaches

1. E.W. Dijkstra (1965) abstracted the key notion of mutual exclusion in his concept of semaphore.
2. The solutions of the critical section problem represented in the section are not easy to generalize to more complex problems.
3. To avoid this complicatedness, we can use a synchronization tool call a semaphore
4. A semaphore S is an integer variable that, apart from initialization, is accessed only through two standard atomic operation: wait and signal. These operations were first termed P (for wait) and V (for signal).

Q 3.

Ans.

① It is the pictorial representation of the state of a system.

② RAG is complete information about all the processes which are holding some resources or waiting for some resources

③ It also contains the information about all the instances of all the resources whether they are available or being used by the processes.

④ In RAG, The process is represented by circle and the Resource is represented by rectangle.

⑤ Vertices

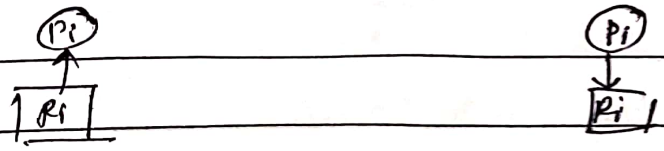
- Process Vertex
  - Pi
- Resources Vertex
  - Single Instance
    - Eg. CPU
  - Multiple Instance
    - Eg. Register.

⑥ Vertices are mainly of 2 types: Resources & process
Each of them will be represented by different shape.

⑦ A resource can have more than one instance.
Each instance will be represented by a dot inside the rectangle.

⑧ Edges

- Assign Edge
- Request edge

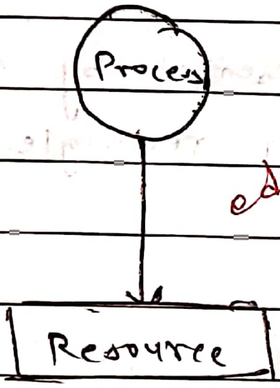


(9) Edges in RAG are of 2 types: Assignment and the wait of a process for a resource.

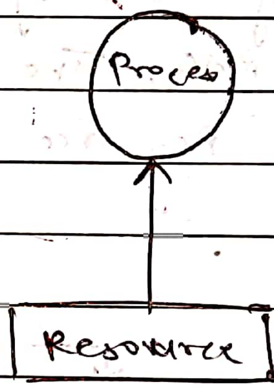
(10) A resource is shown as assigned to a process if the tail of the arrow is attached to an instance to the resource and head is attached to a process.

(11) A process is shown as waiting for a resource if the tail of an arrow is attached to the process while head is pointing towards the resource.

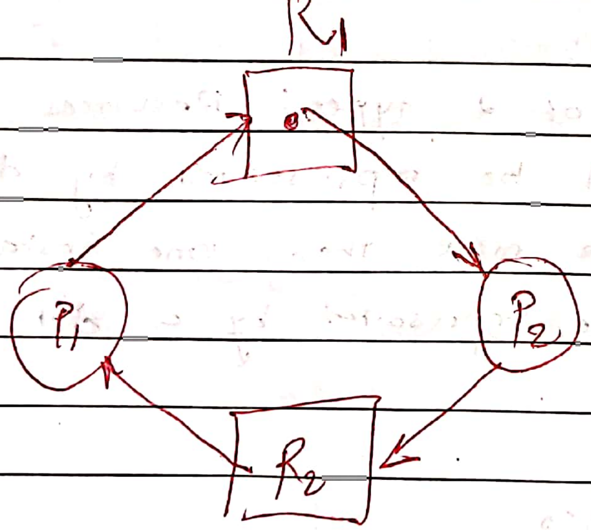
(12)

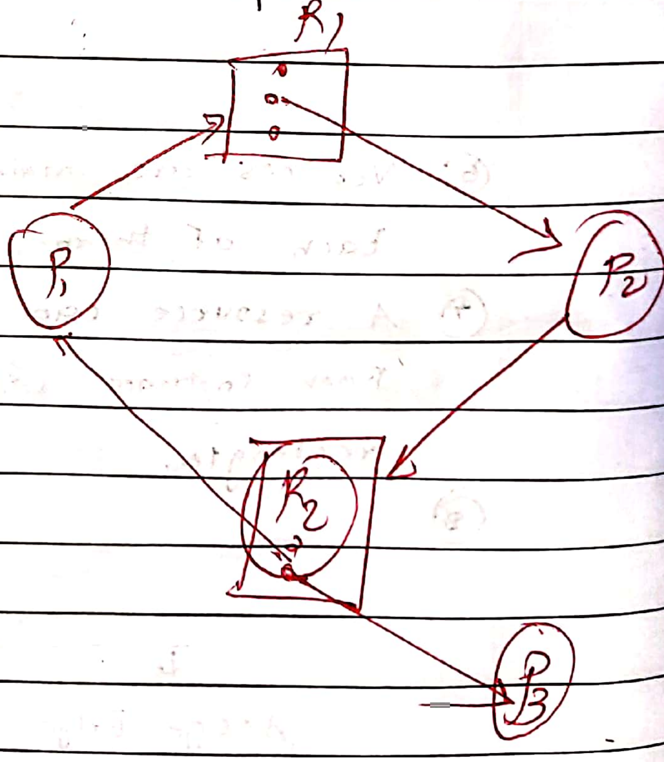


Process is requesting for a resource



Resource is assigned to a process





Q4.

Ans:

Deadlock

① The computer system uses many types of resources which are then used by various processes to carry out their individual function.

② But problem is that the amount of resources available is limited and many process needs to use it.

③ A set of process is said to be in deadlock state when every process in the set is waiting for an event that can be caused only by another process in the set. The event can be resource acquisition, resource release, etc. The resource can be physical (printers, memory space) or logical (semaphores, files).

Techniques to avoid deadlock

① Mutual Exclusion

- Resources shared such as read only files do not lead to deadlocks but resources such as printers and tape drives requires exclusive access by a single process.

② Hold and Wait

- In this condition processes must be prevented from holding one or more resources while simultaneously waiting for one or more others

③ No preemption

- Preemption of process resource allocations can avoid the condition of deadlocks where ever possible

④ Circular Wait

- Circular wait can be avoided if we number all resources and require that process request resources only in strictly increasing or decreasing order.

Q5.

Ans:

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	1	0	7	5	3	3	3	2
P_1	2	0	0	3	2	2			
P_2	3	0	2	9	0	2			
P_3	2	1	1	2	2	2			
P_4	0	0	2	4	3	3			

Need Matrix

Need = Max - Allocation

Process	A	B	C
P_0	7	4	3
P_1	1	2	2
P_2	6	0	0
P_3	0	1	1
P_4	4	3	1

Need $\leq$ Available

P_0 7 4 3 $\leq$ 3 3 2 $\rightarrow$ False Not satisfy

P_1 1 2 2 $\leq$ 3 3 2 $\rightarrow$ True Satisfied

Available = Available + Allocation

= 3 3 2 + 2 0 0

= 5 3 2

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P_2 600 $\leq$ 532 $\rightarrow$ False Not satisfied

P_3 011 $\leq$ 532 $\rightarrow$ True satisfied

Available = Available + Allocation

= 532 + 211

= 743

P_4 431 $\leq$ 743 $\rightarrow$ True satisfied

Available = Available + Allocation

= 743 + 002

= 745

P_0 743 $\leq$ 745 $\rightarrow$ True satisfied

Available = Available + Allocation

= 745 + 010

= 755

P_2 600 $\leq$ 755 $\rightarrow$ True satisfied

Available = Available + Allocation

= 755 + 302

= 10 5 7

Safe sequence

< P_1, P_3, P_4, P_0, P_2 >

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