Operating System Concepts

Sessional Assignment Spring 2020

Marks : 20

==

NAME	**=**	**WASEEM KHAN**
ID	**=**	**14306**
DEPARTEMENT	**=**	**BS(CS) 5TH SEMESTER**
SUBJECT	**=**	**OPERATING SYSTEM**

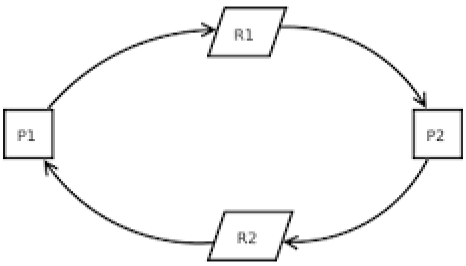
==

1. **Explain the necessary conditions that may lead to a deadlock situation.**

ANS:-

Necessary conditions

A deadlock situation on a resource can arise if and only if all of the following conditions hold simultaneously in a system: Mutual exclusion: At least one resource must be held in a non-shareable mode. Otherwise, the processes would not be prevented from using the resource when necessary.



A deadlock situation on a resource can arise if and only if all of the following conditions hold simultaneously in a system:

1. **Mutual exclusion:** At least one resource must be held in a non-shareable mode. Otherwise, the processes would not be prevented from using the resource when necessary. Only one process can use the resource at any given instant of time.
2. *Hold and wait* or *resource holding:* a process is currently holding at least one resource and requesting additional resources which are being held by other processes.
3. *No* **preemption:** a resource can be released only voluntarily by the process holding it.
4. *Circular wait:* each process must be waiting for a resource which is being held by another process, which in turn is waiting for the first process to release the resource. In general, there is a set of waiting processes, $P = \{P_1, P_2, \ldots, P_N\}$, such that P_1 is waiting for a resource held by P_2, P_2 is waiting for a resource held by P_3 and so on until P_N is waiting for a resource held by P_1

----

2. What are the various methods for handling deadlocks?

===

ANS

Methods for handling deadlock

There are mainly four methods for handling deadlock.

1. Deadlock ignorance

It is the most popular method and it acts as if no deadlock and the user will restart. As handling deadlock is expensive to be called of a lot of codes need to be altered which will decrease the performance so for less critical jobs deadlock are ignored. Ostrich algorithm is used in deadlock Ignorance. Used in windows, Linux etc.

2. Deadlock prevention

It means that we design such a system where there is no chance of having a deadlock.

Mutual exclusion

It can't be resolved as it is the hardware property. For example, the printer cannot be simultaneously shared by several processes. This is very difficult because some resources are not sharable.

Hold and wait

Hold and wait can be resolved using the conservative approach where a process can start it and only if it has acquired all the resources.

Active approach

Here the process acquires only requires resources but whenever a new resource requires it must first release all the resources.

Wait time out

Here there is a maximum time bound until which a process can wait for other resources after which it must release the resources.

Circular wait

In order to remove circular wait, we assign a number to every resource and the process can request only in the increasing order otherwise the process must release all the high number acquires resources and then make a fresh request.

No pre-emption

In no pre-emption, we allow forceful pre-emption where a resource can be forcefully pre-empted. The pre-empted resource is added to the list of resources where the process is waiting. The new process can be restarted only when it regains its old resources. Priority must be given to a process which is in waiting for state.

3. Deadlock avoidance

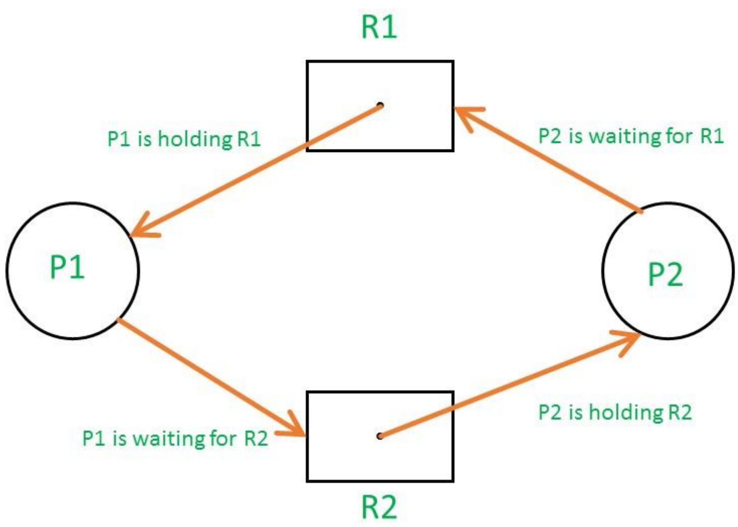
Here whenever a process enters into the system it must declare maximum demand. To the deadlock problem before the deadlock occurs. This approach employs an algorithm to access the possibility that deadlock would occur and not act accordingly. If the necessary condition of deadlock is in place it is still possible to avoid feedback by allocating resources carefully.

Methods for deadlock avoidance

Resource allocation graph

This graph is also kind of graphical bankers' algorithm where a process is denoted by a circle Pi and resources is denoted by a rectangle RJ (.dots) inside the resources represents copies.

Presence of a cycle in the resources allocation graph is necessary but not sufficient condition for detection of deadlock. If the type of every resource has exactly one copy than the presence of cycle is necessary as well as sufficient condition for detection of deadlock.



SINGLE INSTANCE RESOURCE TYPE WITH DEADLOCK

This is in unsafe state (cycle exist) if P1 request P2 and P2 request R1 then deadlock will occur.

4. Detection and recovery

When the system is in deadlock then one method is to inform the operates and then operator deal with deadlock manually and the second method is system will automatically recover from deadlock. There are two ways to recover from deadlock:

Process termination

Deadlock can be eliminated by aborting a process. Abort all deadlock process. Abort is processed at a time until the deadlock cycle is eliminated. This can help to recover the system from file deadlock.

Resources pre-emption

To eliminate deadlock using resources preemption, we prompt the same resources pas processes and give these resources to another process until the deadlock cycle is broken.
Here a process is partially rollback until the last checkpoint or and hen detection algorithm is executed.

==

3. **Is it possible to have a deadlock involving only one single process? Explain your answer.**

==

ANS:-

Deadlock with one process is not possible. Here is the explanation.

A deadlock situation can arise if the following four conditions hold simultaneously in a system.

1. Mutual Exclusion.
2. Hold and Wait.
3. No Preemption.
4. Circular-wait.

It is not possible to have circular wait with only one process, thus failing a necessary condition for Circular wait. There is no second process to form a circle with the first one. So it is not possible to have a deadlock involving only one process.

may be discovered only if several processes are simultaneously active in their critical sections. Note that this situation may not always be reproducible.

- Suppose that a process replaces `signal(mutex)` with `wait(mutex)`. That is, it executes

```
wait(mutex);
   ...
 critical section
   ...
wait(mutex);
```

In this case, a deadlock will occur.

==

4. **Consider a system consisting of 4 resources of the same type that are shared by 3 processes, each of which needs at most 2 resources. Show that the system is deadlock free.**

==

ANS:-

Suppose the system is deadlocked. This implies that each process is holding one resource and is waiting for one more. Since there are three processes and four resources, on process must be able to obtain two resources. This process requires no more resources and therefore it will return its resources when done.

EXAMPL

If the system is deadlocked, it implies that each process is holding one resource and is waiting for one more.

==

5. **What is a resource allocation graph? How do you obtain a wait-for graph from it? Explain their uses.**

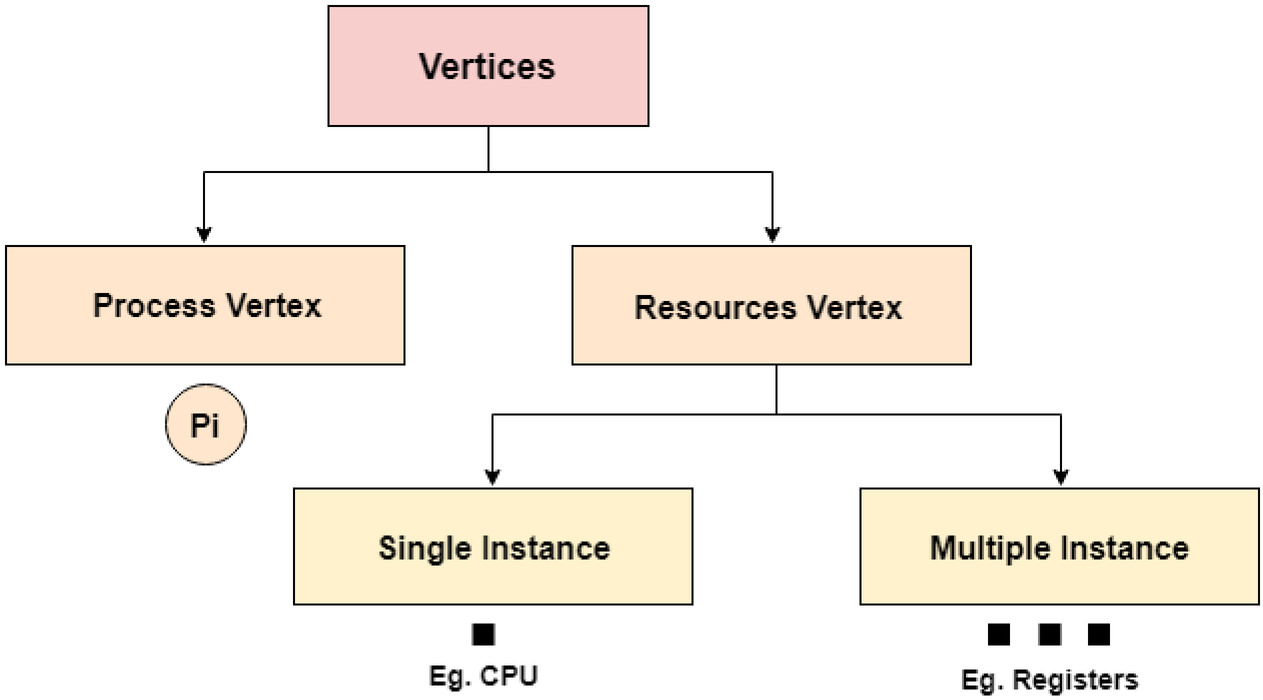
==

ANS:- **Resource allocation graph**

The resource allocation graph is the pictorial representation of the state of a system. As its name suggests, the resource allocation graph is the complete information about all the processes which are holding some resources or waiting for some resources.

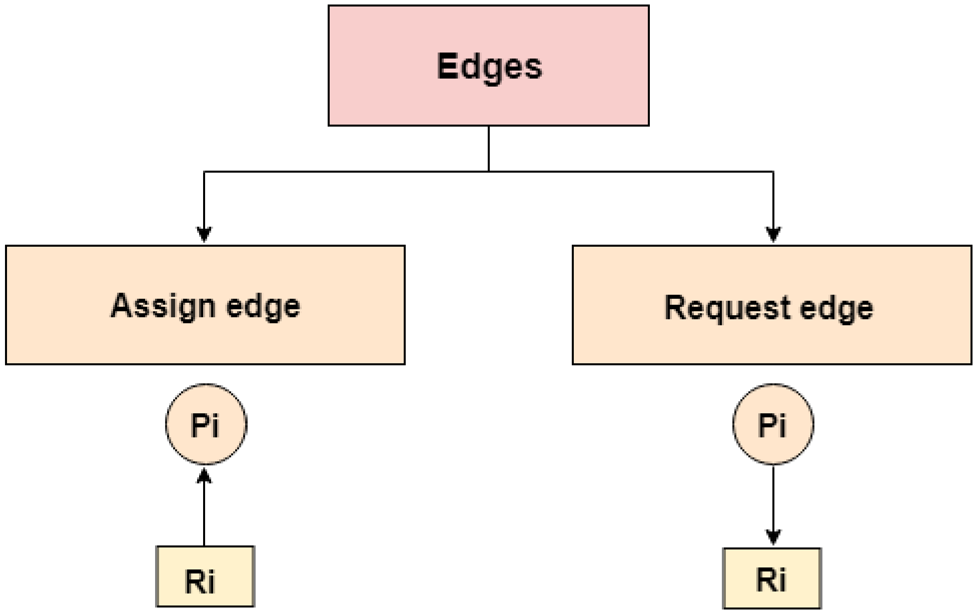
It also contains the information about all the instances of all the resources whether they are available or being used by the processes.

In Resource allocation graph, the process is represented by a Circle while the Resource is represented by a rectangle. Let's see the types of vertices and edges in detail.



Vertices are mainly of two types, Resource and process. Each of them will be represented by a different shape. Circle represents process while rectangle represents resource.

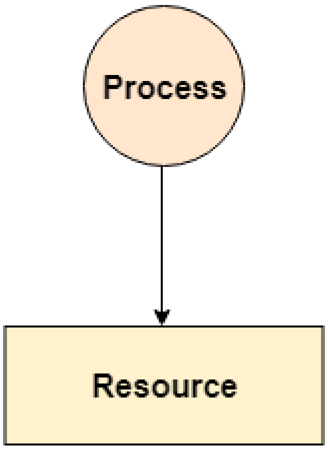
A resource can have more than one instance. Each instance will be represented by a dot inside the rectangle.



Edges in RAG are also of two types, one represents assignment and other represents the wait of a process for a resource. The above image shows each of them.

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

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



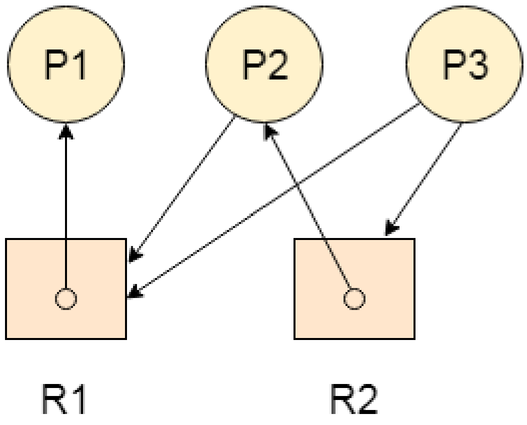
Process is requesting for a resource

Let's understand it by an example:

Let'sconsider 3 processes P1, P2 and P3, and two types of resources R1 and R2. The resources are having 1 instance each.

According to the graph, R1 is being used by P1, P2 is holding R2 and waiting for R1, P3 is waiting for R1 as well as R2.

The graph is deadlock free since no cycle is being formed in the graph.



Consider the following 3 process total resources are given for **A= 6, B= 5, C= 7, D = 6**

Process	maximum				Allocation				Need			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	3	3	2	2	1	2	2	1	2	1	0	1
P2	1	2	3	4	1	0	3	3	0	2	0	1
P3	1	3	5	0	1	2	1	0	0	1	4	0

First we find the need matrix by **Need= maximum – allocation**

Then find available **resources = total – allocated**

```
   A   B   C  D( 6   5  7  6) -   A  B  C  D(  3  4  6  4
   Available resources A B C D(  3 1  1   2)
```

Then we check whether the system is in deadlock or not and find the safe sequence of process.

P1 can be satisfied

```
    Available= P1 allocated + available
    ( 1, 2, 2, 1) +( 3, 1, 1,2) = (4, 3, 3, 3)
```

P2 can be satisfied

```
    Available= P2 allocated + available
    (1, 0, 3, 3) + (4, 3, 3, 3) = (5, 3, 6, 6)
```

P3 can be satisfied

```
    Available= P3 allocated + available
    (1, 2, 1, 0) + (5, 3, 6, 6) = (6, 5, 7, 6)
```

So the system is safe and the safe sequence is **P1 → P2 → P3**

==

6. **Can a system detect that some of its processes are starving? If you answer "yes," explain how it can. If you answer "no," explain how the system can deal with the starvation problem.**

   ==

ANS

Detection of starvation requires future knowledge since no amountof record-keeping statistics on processes can determine if it is making

'progress' or not. However, starvation can be prevented by 'aging' a

process. This means maintaining a rollback count for each process, and

including this as part of the cost factor in the selection

process for a victim for preemption/rollback.

==

7. **On a disk with 1000 cylinders, number 0 to 999, compute the number of tracks the disk arm must move to satisfy all the requests in the disk queue. Assume the last request serviced was at track 345 and the head is moving toward track 0. The queue in FIFO**

order contains requests for the following tracks: 123, 847, 692, 475, 105, 376. Perform the computations for the following disk scheduling algorithms:

- **FCFS**
- **SSTF**

==

ANS:-

FCFS

The FCFS schedule is 345,123,874,692,475,105 and 376.

Total head movement = (345-123) + (874-123) + (874-692) + (692-475) + (475-105) + (376-105) =2013

SSTF

The SSTF schedule is 345,376,475,692,874,123 and 105.

Total head movement = (376-345) + (475-376) + (692-475) + (847-692) + (874-123) +(123-105) = 1298

==