BITS, PILANI-DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
I SEMESTER 2012-2013

COURSE : CS C372 Operating systems III YEAR CS
COMPONENT : Comprehensive Exam (CLOSED BOOK)
DURATION : 3 hrs
WEIGHTAGE : 40% Total Marks:(80 Marks)
Date : 6-1-2013

Q1.Specify the steps for preventing deadlocks among processes running in an operating system.[4M]

	R1	R2	R3
P1	3	2	2
P2	6	1	3
P3	3	1	4
P4	4	2	2

Claim Matrix

	R1	R2	R3
P1	1	0	0
P2	6	1	2
P3	2	1	1
P4	0	0	2

Allocation Matrix

R1	R2	R3
9	3	6

Resource Vector

R1	R2	R3
0	1	1

Available Vector

(a) Initial state

Wrt the above problem

Where claim matrix indicates the total resources requirement of various processes

Allocation matrix indicates the resource allocation already done to the processes

Resource vector indicates the total availability of various types of resources with the OS

And Available vector indicates the remaining resources available to the OS

Now outline step by step how resource allocation can be done using banker's algorithm without any deadlock so that all the processes run for completion.[8M]

Q2.

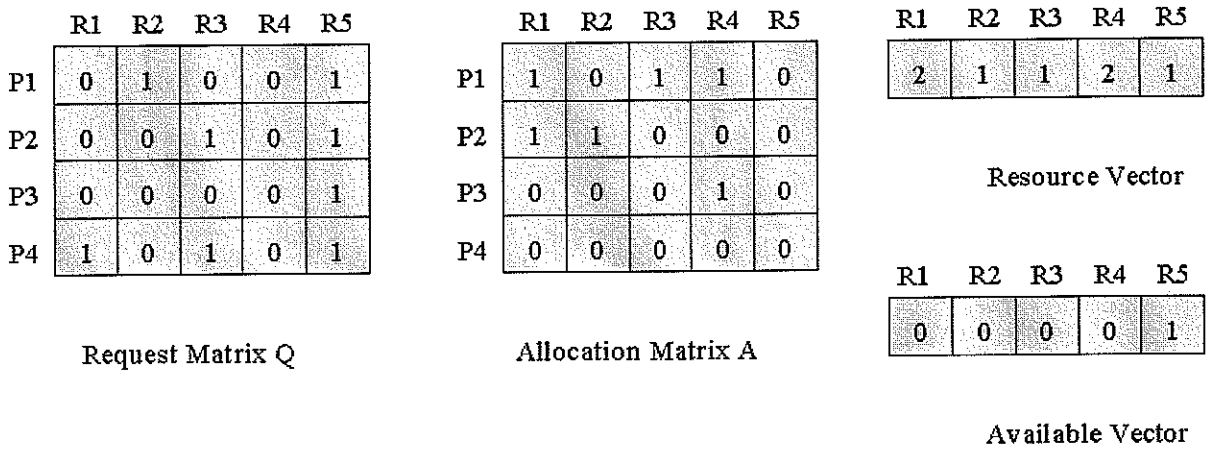


Figure 6.9 Example for Deadlock Detection

In this problem the Requestmatrix indicates the recent instatenous resource request from processes P1,P2,and P3 and P4 and the Allocation matrix indicates the resources already allocated based on previous requests for the above processes. Resource vector indicates the total available resources and the available vector indicates the remaining resources available with OS.

a)Now verify whether any deadlock is there or not using appropriate technique.If any deadlock is there indicate which processes are involved in deadlock and how they got trapped in deadlock.[8]

b)How 2 processes involved in deadlock can recover from the same.[4M]

Q3. Suppose that a disk drive has 5000 tracks, numbered 0 to 4999. The drive is currently serving a request at track 143, and the previous request was at track 125(just useful only for SCAN). The queue of pending requests, in FIFO order, is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130
Starting from the current head position, what is the total distance (in tracks) that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?[4+4+4]
a. FCFS
b. SSTF
c. SCAN

Q4..Outline how main memory is allocated to a new process using dynamic memory. Assume that a new process requires 13M memory. Assume that in the given memory the following vacant slots are available as shown in FIG..How much memory fragmentation will be there in the allocated memory block if you use first fit and best fit strategies.[3M]

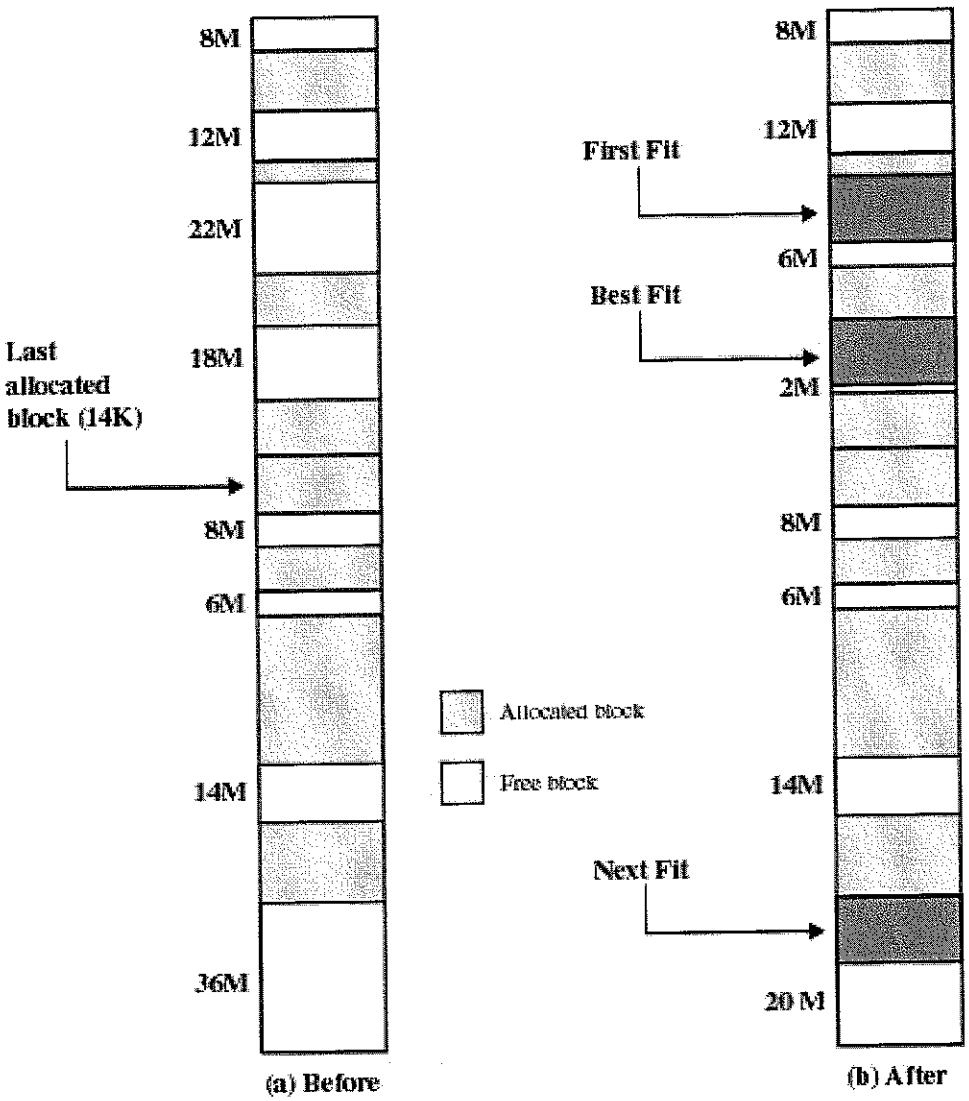


Figure 7.5 Example Memory Configuration Before and After Allocation of 16 Mbyte Block

b) Consider the allocation of memory for the processes [3+3]

P1= 768 bytes , P2=1280 bytes,P3=1024 bytes, and P4= 1024 bytes

Let the total memory available is from = 3840 bytes

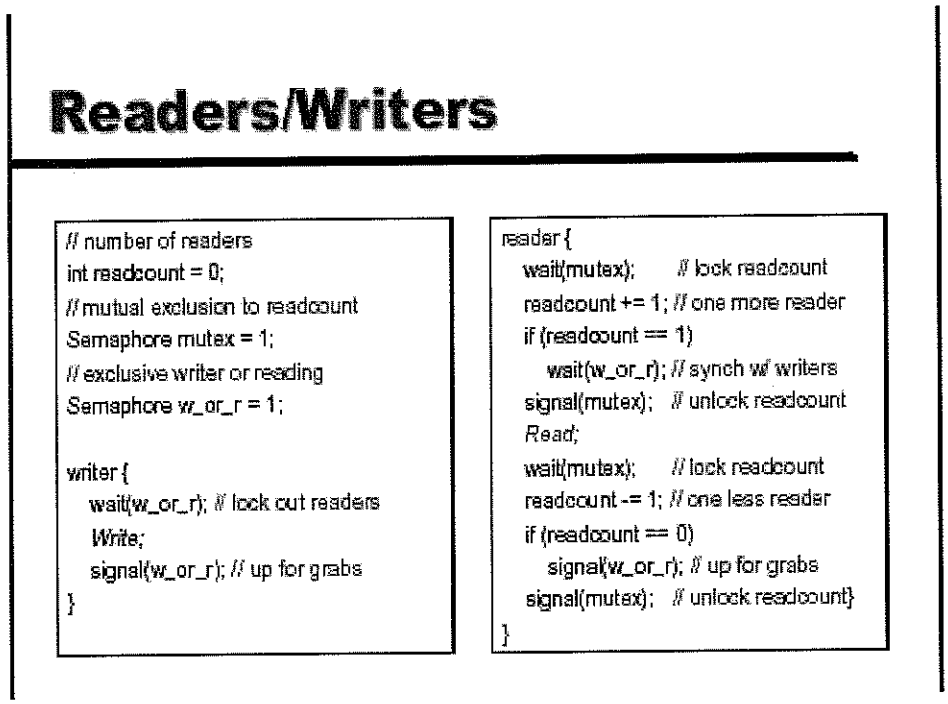
1. With proper reasoning justify how many processes can be run using time shared operating system when you go for dynamic memory based physical memory allocation.

2. Justify how many processes can be run if we have virtual memory allocation using paging technique.(Assume the size of a page is 256 bytes).Draw the page table for each process.

c)what is a page fault and how it can be handled in paging based virtual memory?[3]

Q5a) Outline what are the various possible states a java thread will exist and when it moves to those states(6M)

b)



In the Readers method if the first wait(mutex) method and wait(w_or_r) got exchanged what will be the effect of the same ?[3m}

c) why there is a need for thread pool in a web server?[3M]

Questions for part-A(5*4=20M)

Q1 During multiprogramming, choosing the correct quantum size is important to the effective operation of an operating system. Consider a single processor timesharing system that supports a large number of interactive users. Each time a process gets the processor, the interrupting clock is set to interrupt after the quantum expires. Assume a single quantum for all processes on the system.

a)What would be the effect of setting the quantum at a very large value, say ten minutes ? (2 marks)

b)What if the quantum were set to a very small value , say a few processor(CPU) cycles ?(2 marks)

Q2.with diagrams outline the difference in RAID 0,RAID 1 and RAID 2 array of hard disks and the resultant merits of each one of them.[4M]

Q3.Explain why disable interrupts based locks are not appropriate for implementing synchronization

Primitives in multiprocessor systems.[4 M]

Q4.Suppose you are making a RPC call to a application in server1 and another application in server2 from a client.. with diagram outline how using kernel level multithreaded client you can get better response compared to single thtreaded client.[4 M]

Q5.Justify which operating structure satisfy each of the following traits with reasons.[4M]

a).Improved security

b).Easy to implement and hard to troubleshoot

c)Better troubleshooting but not easy to customize

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COURSE	: CS C372	Operating systems	III YEAR	CS
COMPONENT	: TEST – 2	(open BOOK)		
DURATION	: 50 MINS			
WEIGHTAGE	: 20% (20 Marks)			
Date	: 9-12-2012			

Q1.

Bounded Buffer (3)

```
Semaphore mutex = 1;  // mutual exclusion to shared set of buffers
Semaphore empty = N;  // count of empty buffers (all empty to start)
Semaphore full = 0;   // count of full buffers (none full to start)
```

```
producer {
 while (1) {
  Produce new resource;
  wait(empty); // wait for empty buffer
  wait(mutex); // lock buffer list
  Add resource to an empty buffer;
  signal(mutex); // unlock buffer list
  signal(full);  // note a full buffer
 }
}
```

```
consumer {
 while (1) {
  wait(full);   // wait for a full buffer
  wait(mutex);  // lock buffer list
  Remove resource from a full buffer;
  signal(mutex); // unlock buffer list
  signal(empty); // note an empty buffer
  Consume resource;
 }
}
```

a)Wrt the above solution for bounded buffer problem what will happen if the wait(full) and wait(mutex) statements are interchanged in the consumer code whereas let of the code remains the same as given in the above Fig.[2.5M]

b) Similarly what will happen if the wait(empty) and wait(mutex) statements are interchanged in the Producer code whereas let of the code remains the same as in above FIG.[2.5m]

3. public class Threadsync implements Runnable
{

```
    public static void main(String[] args)

    {
        Lock lockobj = new Lock();
        Counter counterobj = new Counter();

      Threadsync syncobject1 = new Threadsync();
      Thread threadobj1=new Thread(syncobject1);
      Thread threadobj2=new Thread(syncobject1);
      threadobj1.start();
      threadobj2.start();
    }
    public  void run()
    {
        this.display("Arun");
    }
     synchronized void display ( String s) {
           System.out.println("("+s);

           try {
                Thread.sleep(1000);
           } catch ( InterruptedException e) {
System.out.println("Interrupted");}

           System.out.println(")");
     }
    }
```

a)Wrt the above program what will be the output ?[1]

b)What are the various states the thread which is created using the code will undergo in the above program?[2m]

```
Thread threadobj1=new Thread(syncobject1);
```

c)Suppose you remove synchronized prefix in front of void `display ( String s)`

Then how the output may look like?[2M]

Q4.Assume that the system in which the web server runs supports multiple CPUS.Why there is a need for having a multithreaded(kernel threads) web server process?[2M]

a) Suppose instead of having kernel level threads you have user threads in the above web server. What are the performance limitations you will face due to that?[3M]

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DURATION	: 50 MINS			
WEIGHTAGE	: 20% (20 Marks)			
Date	: 29-10-2012			

Q1.Consider a system which is running 2 processes by name P1 and P2. Let P1 does the speed control of DC motor by comparing the ref speed with feedback speed. Let p2 is a process which just does numeric computation. Let the OS schedules the process P1 first for 100 msec and then p2 for another 100msec like that it goes on.Whenever the process P1 is scheduled let a hardware interrupt1 happens immediately after its scheduling (at intervals of 100msec) and interrupt the system to inform that it is time for feedback speed measurement. Let there is another HW interrupt2 called Quantum interval expiry interrupt .Justify which interrupt is responsible for mode switch only and which is responsible for mode switch followed by process switch.[4M]

Q2.Consider an operating system which schedules the following types of processes

P1 process (contains full of CPU intensive instructions)

P2 (contains mixture of 50% CPU intensive and 50% I/O instructions)

P3 (contains mixture of 30% CPU intensive and 70% I/O instructions)

what is the limitation of using round robin based process scheduling technique for the above 3 processes. Justify how the above limitation can be overcome using priority based scheduling?[2+2]

Q3.

```
public class ThreadDemo implements Runnable
{
  // instance variables - replace the example below with your own
  private int x;
  private int y;
```

```
/**
 * Constructor for objects of class ThreadDemo
 */
public ThreadDemo()
{
   // initialise instance variables
  int numerator =6*7*8*9;
   this.x=numerator;
}

/**
 * An example of a method - replace this comment with your own
 *
 * @param  y   a sample parameter for a method
 * @return     the sum of x and y
 */
public void run()

{
  // put your code here
 //compute denominator and store in variable y

 int denom =1*2*3;
 try
 {
  Thread.sleep(2000);
 }
 catch (Exception e)
{

 }
 this.y =denom;
 System.out.println( "denom="+ y);
```

```
    //System.out.println("final result=" + this.x/this.y);
  }
  public static void main(String[]args)
  {
    ThreadDemo obj1=new ThreadDemo();
    Thread threadobj=new Thread(obj1);
    threadobj.start();
    try
    {
     Thread.sleep(1000);
    }
    catch (Exception e)
   {

    }
    System.out.println(obj1.x);
    System.out.println(obj1.y);
    double result=(obj1.x)/(obj1.y);
    System.out.println(result);

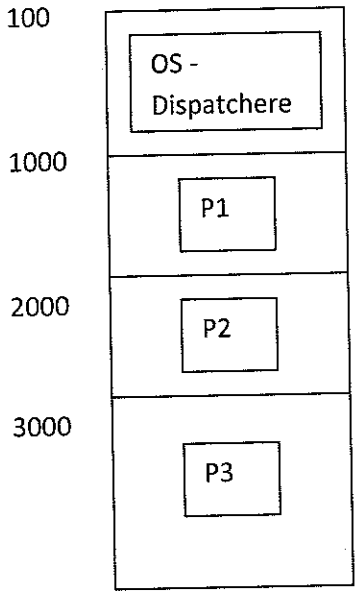

  }
}
```

a) The above java program is an example of applying multithreading foe computing the value of Nr/Dr. Now justify what will be result of the above execution?[2M]

b) Suppose
   Thread.sleep(300);

   is modified as above in the run() method. Now justify what will be result of the above execution?[2M]

Q4.Given the snapshot of execution of process in an OS outline the activities that are happening in the system. (4 Marks)



1 1000	12 100
2 1001	13 101
3 1002	14 102
----------(Time Out)	15 103
4 100	16 3000
5 101	17 3001
6 102	18 3002
7 103	19 3003
8 2000	20 3004
9 2001	----------(Time out)
10 2002	21 100
11 2003	22 101
----------(Time Out)	23 102
	24 103
	25 1003
	25 1004

P.T.O

Show the contents of the PC (Program Counter) in the PCB of each of the processes at the 7th, 15th and 24th instructions shown in the execution trace. Assume that the initial values of PC stored in the PCBs of each process is 1000, 2000, and 3000 respectively.

Q5.Justify which operating structure you prefer under the following conditions?[1+1+2]

a) Easy to implement within short time

b)latency in the OS can be neither low nor very high but at the same time the structure should facilitate easy means to debug errors during the building of OS

c)A structure which if adopted will enable a non distributed OS to distributed OS with minimal efforts but latency will be highest

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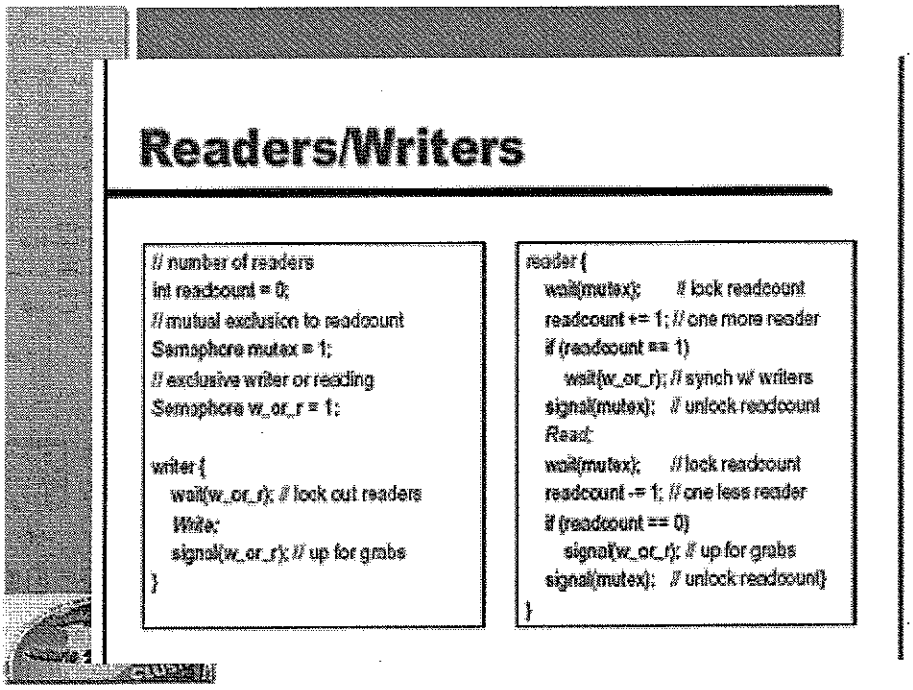
DURATION	: 20 MINS			
WEIGHTAGE	: 10% (10 Marks)			
Date	: 21-11-2012			

Q1.specify 2 important advantages of semaphore compared to locks?[2M]



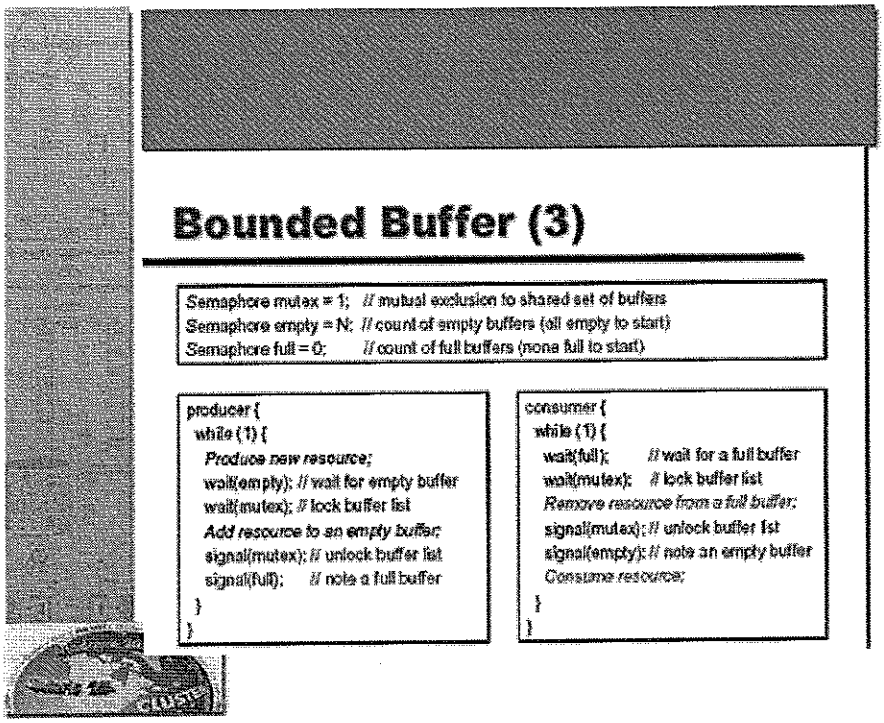
Q2.Consider the readers/writer problem.

Let a writer thread starts at t=0; Reader thread1 starts at t =5 msec.; Reader thread2 starts at

t=7 msec. Assume that Read operation within Reader method takes 10msec and Write method within Writer consumes 10 msec. Ignore the time of execution of all other instructions compared to Read or Write operations.

At t=8 secs ,Specify the threads that will be in blocked state and the queues in which the blocked threads reside.[2M]

3.wrt the above problem if you do not have semaphores what will happen to readers/writer threads?[1m]



Bounded Buffer (3)

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  Add resource to an empty buffer;
  signal(mutex); // unlock buffer list
  signal(full);  // note a full buffer
 }
}
```

```
consumer {
 while (1) {
  wait(full);    // wait for a full buffer
  wait(mutex);   // lock buffer list
  Remove resource from a full buffer;
  signal(mutex); // unlock buffer list
  signal(empty); // note an empty buffer
  Consume resource;
 }
}
```

4.Assume that the above bounded buffer has max 5 slots. Let the producer thread is fast compared to consumer thread. In that case soon the buffer will be full. Justify whether the producer thread will succeed in adding 6^{th} item it produced into the buffer?[2m]

5. Wrt the above problem if a consumer thread is faster than the producer thread then soon the buffer will be empty. In that case what prevents the consumer thread from not reading anything from the buffer when it is empty?[2m]

Q6. Wrt the bounder buffer problem if you do not have semaphores what will happen when producer and consumer operates at different speeds?[1m]

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Q1. Why there is a need for processor state information in the PCB of a process?[1m]

Q2.

```
static int a;

void printtid()

{

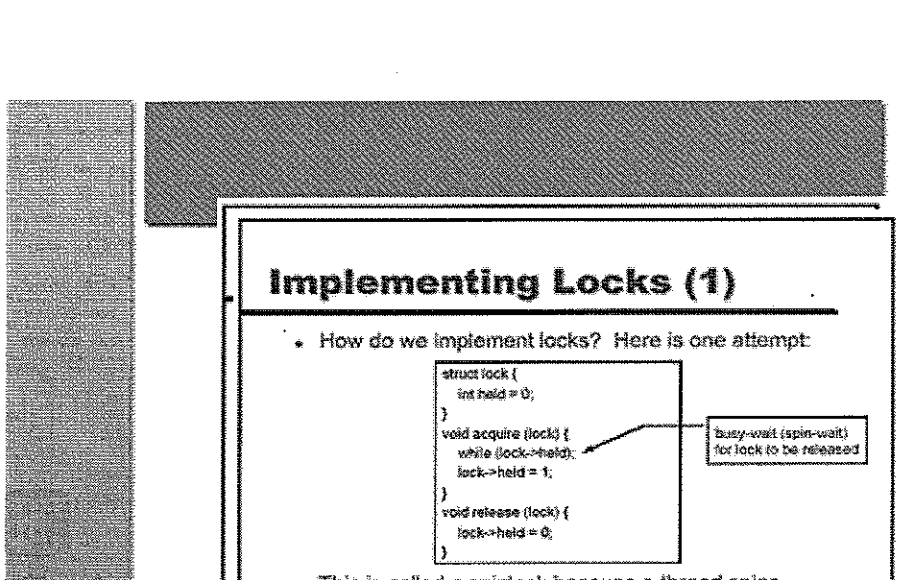
a= mytid();

cout << a;

}
```

Consider the code as shown above within a process. Let 2 threads T1 and T2 are spawned to run the above method. Let ID of T1 is 100 and that of T2 is 200. Let mytid() is a method which will give the ID of the calling thread. Let there is only a single CPU in the system. Now I want to get printout of 100 followed by 200. With proper reasoning justify when I may not get the result as expected [2 M]

Q3.Justify how will you achieve synchronization between the 2 threads mentioned above with proper steps that confirm that synchronization takes palce ?[2M]



Q4

What is the disadvantage of using the above implementation for lock ?[2M]

Q5. How will you implement a DI based lock ?[2M]

Q6. Specify 1 important adavantage and disadavantage of spin lock compared to DI type of lock ?[1m]