Operating System Assignment
B.Tech MCE 3rd year
Assignment -1
Unit – 1, 2(OS Introduction, Process Management, CPU Scheduling and Threads)

1. Differentiate between
    a. System call and System program
    b. Symmetric and asymmetric multiprocessing
    c. Batch programming Multitasking and Multiprogramming
    d. Hard and soft real time systems
    e. Microkernel and Monolithic approach

2. What are the main features and design challenges of Distributed operating systems.

3. Which of the following instructions should be privilege**?**
    a. Set value of timer.
    b. Read the clock.
    c. Clear memory.
    d. Issue a trap instruction.
    e. Turn off interrupts.
    f. Modify entries in device-status table.
    g. Switch from user to kernel mode.
    h. Access I/O device.

4. Explain the functions and requirements of multiprocessing OS.

5. How does the distinction between monitor mode and user mode function as a rudimentary form of protection?

6. What are the differences between a trap and interrupt? Can traps be generated intentionally by a user program? If so, for what purpose.

7. Which of the following will probably improve CPU utilitzation? Explain your answer.
    a. Install a faster CPU
    b. Increase the number of processes
    c. Decrease the number of processes
    d. Install more main memory
    e. Increase the page size

8. What is the main advantage of the layered approach to system design?

9. Provide two programming examples in which multithreading provides better performance than a single-threaded solution

10. A CPU-scheduling algorithm determines an order for the execution of its scheduled processes. Given n processes to be scheduled on one processor, how many different schedules are possible? Give a formula in terms of n.

11. Describe the lifecycle of any process. Explain all the necessary work (record keeping) during the transition from one state to another.

12. What is a zombie? List 2 events that will kill a zombie.

13. Each process is assigned a numerical priority, with a higher number indicating a higher relative priority. In addition to the processes listed below, the system also has an idle task (which consumes no CPU resources and is identified as P idle). This task has priority 0 and is scheduled whenever the system has no other available processes to run. The length of a time quantum is 10 units. If a process is preempted by a higher-priority process, the preempted process is placed at the end of the queue.

Thread	Priority	Burst	Arrival
P1	40	20	0
P2	30	25	25
P3	30	25	30
P4	35	15	60
P5	5 (highest)	10	100
P6	10	10	105

14. Show the scheduling order of the processes using a Gantt chart.
    a. What is the turnaround time for each process?
    b. What is the waiting time for each process?
    c. What is the CPU utilization rate?

15. Discuss how the following pairs of scheduling criteria conflict in certain settings.
    d. CPU utilization and response time
    e. Average turnaround time and maximum waiting time
    f. I/O device utilization and CPU utilization

16. Draw the Gantt chart and calculate the Average Wait Time, Average Turnaround Time and Average Response Time for the following scheduling algorithms:

Process ID	Arrival Time	Burst Time	Priority
P1	0.0	8	2
P2	0.4	4	0
P3	1.0	1	1(highest)

Find the average wait time, average response time for Round Robin scheduling using time quantum to be 2.

Find the average turnaround time, average response time for Priority scheduling under preemptive approach.

17. Describe the action taken by kernel to context switch :
    a. Among Threads
    b. Among processes

Which context switch would be faster?

18. Consider the following code fragment:

```
if (fork() == 0)
{ a = a + 5; printf("%d,%dn", a, &a); }
else
{ a = a –5; printf("%d, %dn", a, &a); }
```

Predict the output.

19. Consider the following statements with respect to user-level threads and kernel-supported threads
    a. context switch is faster with kernel-supported threads
    b. for user-level threads, a system call can block the entire process
    c. Kernel supported threads can be scheduled independently
    d. User level threads are transparent to the kernel

Which of the above statements are true?

20. What are the benefits and the disadvantages of each of the following? Consider both the system level and the programmer level.
    a. Synchronous and asynchronous communication
    b. Automatic and explicit buffering
    c. Send by copy and send by reference
    d. Fixed-sized and variable-sized messages

21. Compare and contrast in brief the different multithreading models?

22. A uni-processor computer system only has two processes, both of which alternate 10 ms CPU bursts with 90 ms I/O bursts. Both the processes were created at nearly the same time. The I/O of both processes can proceed in parallel. Which of the following scheduling strategies will result in the least CPU utilization (over a long period of time) for this system and why?

23. Consider the following set of processes, with the arrival times and the CPU burst times given in milliseconds.

Process	Arrival-Time	Burst-Time
P1	0	5
P2	1	3
P3	2	3
P4	4	1

    What is the average turnaround time for these processes with the preemptive shortest remaining processing time first (SRPT) algorithm?

24. Consider three processes (process id 0, 1, 2 respectively) with compute time bursts 2, 4 and 8-time units. All processes arrive at time zero. Consider the longest remaining time first (LRTF) scheduling algorithm. In LRTF ties are broken by giving priority to the process with the lowest process id. Find the average turn around time.

25. Consider three processes, all arriving at time zero, with total execution time of 10, 20 and 30 units, respectively. Each process spends the first 20% of execution time doing I/O, the next 70% of time doing computation, and the last 10% of time doing I/O again. The operating system uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?

Operating System Assignment
B.Tech MCE 3rd year
Assignment - 2

Unit – Three
(Dead Lock Management and Mass storage Structure)

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

2. A computer system has 6 tape drives, with n process competing for them. Each process may need 3 tape drives. What is the maximum value of n for which the system is guaranteed to be deadlock free?

3. Suppose n processes, P1, …. Pn share m identical resource units, which can be reserved and released one at a time. The maximum resource requirement of process Pi is Si, where Si > 0. Which one of the following is a sufficient condition for ensuring that deadlock does not occur?

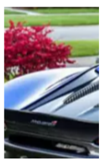
4. Consider a system with 3 processors that share 4 instances of the same resource type. Each process can request a maximum of K instances. Resources can be requested and releases only one at a time. The largest value of K that will always avoid deadlock is ___

5. Consider an operating system capable of loading and executing a single sequential user process at a time. The disk head scheduling algorithm used is First Come First Served (FCFS). If FCFS is replaced by Shortest Seek Time First (SSTF), claimed by the vendor to give 50% better benchmark results, what is the expected improvement in the I/O performance of user programs?

6. Consider a system with 4 types of resources R1 (3 units), R2 (2 units), R3 (3 units), R4 (2 units). A non-preemptive resource allocation policy is used. At any given instance, a request is not entertained if it cannot be completely satisfied. Three processes P1, P2, P3 request the sources as follows if executed independently.

Process P1:	Process P2:	Process P3:
t=0: requests 2 units of R2	t=0: requests 2 units of R3	t=0: requests 1 unit of R4
t=1: requests 1 unit of R3	t=2: requests 1 unit of R4	t=2: requests 2 units of R1
t=3: requests 2 units of R1	t=4: requests 1 unit of R1	t=5: releases 2 units of R1
t=5: releases 1 unit of R2 and 1 unit of R1.	t=6: releases 1 unit of R3	t=7: requests 1 unit of R2
t=7: releases 1 unit of R3	t=8: Finishes	t=8: requests 1 unit of R3
t=8: requests 2 units of R4		t=9: Finishes
t=10: Finishes		

Which one of the following statements is TRUE if all three processes run concurrently starting at time t=0?

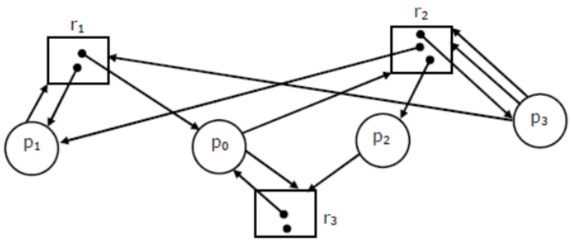


7. Consider the following policies for preventing deadlock in a system with mutually exclusive resources. Which of the policies can be used for preventing deadlock?
   a. Process should acquire all their resources at the beginning of execution. If any resource is not available, all resources acquired so far are released.
   b. The resources are numbered uniquely, and processes are allowed to request for resources only in increasing resource numbers

c. The resources are numbered uniquely, and processes are allowed to request for resources only in decreasing resource numbers
d. The resources are numbered uniquely. A process is allowed to request for resources only for a resource with resource number larger than its currently held resources

8.

Consider the resource allocation graph given in the figure.



(a) Find if the system is in a deadlock state.
(b) Otherwise, find a safe sequence.

9. A computer system uses the Banker's Algorithm to deal with deadlocks. Its current state is shown in the tables below, where P0, P1, P2 are processes, and R0, R1, R2 are resource types.

	Maximum Need				Current Allocation			Available		
	R0	R1	R2		R0	R1	R2	R0	R1	R2
P0	4	1	2	P0	1	0	2	2	2	0
P1	1	5	1	P1	0	3	1			
P2	1	2	3	P2	1	0	2			

(a) Show that the system can be in this state.
(b) What will system do on a request by process P0 for one unit of resource type R1?

10. Suppose that a disk drive has 5000, cylinders numbered from 0 to 4999. This drive is currently a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests in FIFO order is 86, 1470, 913, 1774, 130. Starting from the current head position, what is the total distance (in cylinder) that the disk arm moves to satisfy the entire pending request for the following disk scheduling algorithms?
a. SSTF
b. LOOK
c. C-SCAN

11. Disk request come to disk driver for cylinder 10,22,20,2,40, 56 and 38, in that order at a time when the disk drive is reading from cylinder 20. The seek time is 6 millisecond per cylinder. Compute total seek time if the disc scheduling algorithm is
a. First Come First served
b. Closest cylinder next
c. Elevator disc scheduling policies

12. A certain moving arm disc-storage has the following a specification:
Number of track per surface=4004
Track the storage capacity=130030 bytes
Disk speed =3600 rpm
Average seek time=30 m secs.
Estimate the average latency the disc storage capacity and that data transfer rate.