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Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

END SEMESTER EXAMINATION

B. E. (Second/Third Year) 2018-19 (COE/ECE/ENC)	Course Code: UCS 303 Course Name: Operating Systems
12th December, 2018	Time: 09:00-12:00 Hrs
Time: 3 Hours, M. Marks: 100	Name Of Faculty: VIK, AKM, RKG, TBH, SKT, RJK, NKK, AMP

Note: Attempt all questions in proper sequence. Assume missing data, if any, suitably

Q.1 (a)	What is the purpose of interrupts? What are the differences between a trap and an interrupt? Can traps be generated intentionally by the user program? If so, for what purpose?	(06)
Q.1 (b)	What is the purpose of the command interpreter? Why is it usually separate from the kernel? Would it be possible for the user to develop a new command interpreter using the system-call interface provided by the operating system?	(04)
Q.1 (c)	Consider a typical disk that rotates at 15000 rotations per minute (RPM) and has a transfer rate of 50 × 10^6 bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time, What is the average time (in milliseconds) to read or write a 512 byte sector of the disk?	(10)

Q.2 Consider the following set of processes, with the length of the CPU-burst time given in milliseconds: (20)

Process Priority	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The processes are assumed to have arrived in the order *P*1, *P*2, *P*3, *P*4, *P*5, all at time 0.

1. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-pre-emptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.
2. What is the turnaround time of each process for each of the scheduling algorithms in **part 1**?
3. What is the waiting time of each process for each of the scheduling algorithms in **part 1**?
4. Which of the scheduling algorithm in **part 1** result in the minimal average waiting time (over all processes)?

Q.3 (a) In a real computer system, neither the resources available nor the demands of processes for resources are consistent over long periods (months). Resources break or are replaced, new processes come and go, and new resources are bought and added to the system. If deadlock is controlled by the banker's algorithm, which of the following changes can be made safely (without introducing the possibility of deadlock), and under what circumstances? (12)

I. Increase Available (new resources added).
II. Decrease Available (resource permanently removed from system).
III. Increase Max for one process (the process needs or wants more resources than allowed).
IV. Decrease Max for one process (the process decides it does not need that many resources).
V. Increase the number of processes.
VI. Decrease the number of processes.

Q.3 (b)	Consider a demand paging system with a paging disk that has an average access and transfer time of 20 milliseconds. Addresses are translated through a page table in main memory, with an access time of 1 millisecond per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference, if the page table entry is in associative memory. Assume that 80 percent of the accesses are in associative memory and that, of the remaining, 10 percent (or 2 percent of the total) cause page faults. What is the effective memory access time?	(08)
Q.4 (a)	Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the following replacement algorithms, assuming 5 frames? Assume all frames are initially empty, so first unique pages will all cost one fault each. I. LRU II. FIFO III. Optimal replacement	(12)
Q.4(b)	How is protection implemented using an access matrix? Explain with a suitable example.	(08)
Q.5 (a)	Compare the performance of three techniques for allocating disk block (contiguous, Linked and indexed) for both sequential and random file access.	(06)
Q.5 (b)	A counting semaphore was initialized to 10. Then 6 P (wait) operations and 4V (signal) operations were completed on this semaphore. Calculate the resulting value of the semaphore.	(04)
Q.5 (c)	Write an algorithm to solve producer consumer problem.	(06)
Q.5 (d)	Fetch_And_Add(X,i) is an atomic Read-Modify-Write instruction that reads the value of memory location X, increments it by the value i, and returns the old value of X. It is used in the pseudocode shown below to implement a busy-wait lock. L is an unsigned integer shared variable initialized to 0. The value of 0 corresponds to lock being available, while any non-zero value corresponds to the lock being not available.	(04)

```
AcquireLock(L){
    while (Fetch_And_Add(L,1))
        L = 1;
}
ReleaseLock(L){
    L = 0;
}
```

What will be the output of this code? Justify your answer.