B.TECH/CSE/5TH SEM/CSEN 3103/2018
OPERATING SYSTEMS
(CSEN 3103)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which of the following scheduling algorithm does give minimum average waiting time?
(a) FCFS (b) SJF (c) RR (d) Priority Scheduling.

(ii) What is the ready state of a process?
(a) when process is scheduled to run after some execution
(b) when process is unable to run until some task has been completed
(c) when process is using the CPU
(d) none of the mentioned.

(iii) Fixed size contiguous memory allocation can lead to
(a) internal fragmentation (b) external fragmentation
(c) both (a) and (b) (d) none of these.

(iv) If a process has 32k bytes of logical address space and the page size is 2048 bytes then the number of frames of that process is
(a) 4 (b) 16 (c) 8 (d) 32.

(v) The circular wait condition can be prevented by:
(a) defining a linear ordering of resource types
(b) using threads
(c) using pipes
(d) all of the above mentioned.

(vi) The disadvantage of a process being allocated all its resources before beginning its execution is :
(a) Low CPU utilization (b) Low resource utilization
(c) Very high resource utilization (d) None of these.

(vii) If a process is executing in its critical section, then no other process can be executing in its critical section. This condition is called
(a) mutual exclusion (b) critical exclusion
(c) synchronous exclusion (d) asynchronous exclusion.

(viii) A monitor is a module that encapsulates
(a) shared data structures
(b) procedures that operate on shared data structure
(c) synchronization between concurrent procedure invocation
(d) all of the above mentioned.

(ix) A state is safe, if :
(a) the system does not crash due to deadlock occurrence
(b) the system can allocate resources to each process in some order and still avoid a deadlock
(c) the state keeps the system protected and safe
(d) all of these.

(x) CPU fetches the instruction from memory according to the value of
(a) program counter (b) status register
(c) instruction register (d) program status word

Group – B

2. (a) What is multiprocessor or tightly coupled system? Explain the three main advantages of multiprocessor system.

(b) Explain how multiprogramming operating system increases CPU utilization.

(c) What is the main advantage of the microkernel approach to system design? How do user programs and system services interact in a microkernel architecture?

(2 + 3) + 3 + (2 + 2) = 12

3. (a) What is the purpose of interrupts? What are the differences between a trap and an interrupt? Can traps be generated intentionally by a user program? If so, for purpose?

(b) Describe a mechanism for enforcing memory protection in order to prevent a program from modifying the memory associated with operating system and other user programs.

(2 + 2 + 2) + 6 = 12

Group – C

4. (a) What is critical section (CS) problem? What are the requirements a CS problem must satisfy?

(b) What is deadlock? What are the necessary conditions for deadlock to occur?

(c) Consider the following snapshot of a system with 5 processes, P0 through P4 and three resource types A, B and C.

	A	B	C
Instances	10	5	7

At time t_0, snapshot of the system:

	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 the Banker's algorithm:-

(a) What is the content of the matrix Need?

(b) Is the system in a safe state?

(c) If a request from process P1 arrives for (1, 0, 2), can the request be granted immediately?

(1 + 2)+(1 + 2) +6 = 12

5. (a) Explain how Peterson's solution solves mutual exclusion and progress for two processes.

(b) Consider the following set of processes, with the length of the CPU burst time is given in millisecond.

Process	Burst time	Arrival time	Priority
P1	6	0	3
P2	10	3	1
P3	8	5	3
P4	5	7	4
P5	6	10	2

(i) Draw a Gantt chart by using non-preemptive and pre-emptive priority scheduling policy (lower number implies a higher priority) scheduling.

(ii) Find the completion time and response time.

(iii) Find the average waiting time and average turn around time.

(2 + 2) + (2 +2 +2 +2) = 12

Group – D

6. (a) Consider the data given in following table:

Partition Size (KB)	4 KB	8 KB	20 KB	2 KB				
Job Size (KB)	2 KB	14 KB	3 KB	6 KB	6 KB	10 KB	20 KB	2 KB
Burst Time (ms)	4	10	2	1	4	1	8	6

When will the job of size 20 KB get the memory and be completed, if the best fit algorithm is used for allocating jobs to various memory partitions (assuming all jobs arriving at the same time)?

(b) Consider we have the following reference string:

5, 0, 4, 4, 0, 3, 0, 4, 1, 0, 2, 0, 5, 3, 0, 1

Find the page fault of virtual memory using LRU algorithm, where we used 4 frames-

(c) Consider a logical address space of eight pages of 1024 words each, mapped onto a physical memory of 32 page frames. Answer the following:

(i) How many bits are there in the logical address?

(ii) How many bits are there in the physical address?

(d) Consider a paging system with the page table stored in the main memory. Answer the following:

(i) If the main memory access time is 200 ns, how long does a paged memory reference take?

(ii) If we use TLB, and 75% of page table references are found in the TLB, then what is the effective reference time? (Assume that finding a page table entry in TLB takes zero time if the entry is found.)

3 * 4 = 12

7. (a) Consider the following memory references have been generated by a program:

0100, 0432, 0101,0612, 0102, 0103, 0104, 0101, 0611, 0102, 0103, 0104,0101,0610, 0102, 0103, 0104, 0101, 0609, 0102, 0105

At 100 bytes per page, determine the number of page faults in each of the following page replacement policies assuming 3 frames are available

Also assume that initially none of the pages are in main memory.

(i) LRU

(ii) Optimal

Consider a virtual memory system with combined implementation, segmentation and paging. Describe the address translation scheme along with necessary data structures.

(b) Suppose a disk drive has 300 cylinders, numbered 0 to 299.The current head position of the disk is at 90. The queue of pending requests in FIFO order is 36,79, 15,120, 199, 270, 89, 170. Calculate average cylinder movements for the following algorithms.

(i) SSTF
(ii) C-SCAN

(c) Consider a paged memory system. Specify what information will be stored in PCB to support memory management. What is the purpose of modify bit in the page table?

(2 + 2) + (2 + 2) + (2 + 2) = 12

Group – E

8. (a) A password may become known to other users in a variety of ways. Is there a simple method for detecting that such an event has occurred? Explain your answer.

(b) Discuss a means by which managers of systems connected to the Internet could design their systems to limit or eliminate the damage done by worms. What are the drawbacks of making the change that you suggest?

(c) What are the two advantages of encrypting data stored in the computer system?

(d) What commonly used computer programs are prone to the man-in-the-middle attacks? Discuss solutions for preventing this form of attack.

3 + 3 + 2 + 4 = 12

9. (a) Discuss how the asymmetric encryption algorithm that can be used to achieve the following goals.

(i) Authentication: the receiver knows that only the sender could have generated the message.
(ii) Secrecy: only the receiver can decrypt the message
(iii) Authentication and secrecy: only the receiver can decrypt the message, and the receiver knows that only the sender could have generated the message.

(b) Explain one-time password systems to prevent improper authentication due to password exposure.

(3 * 3) + 3 = 12