

B.Sc. (Honours) Examination, 2018
Semester-III
Computer Science
Course : CC-6
(Operating Systems)

Time : 3 Hours

Full Marks : 40

Questions are of value as indicated in the margin

Answer question **No.1** and **any four** from the rest.

1. Answer **any four** of the following: 4×2=8
- Draw the state transition diagram of a process.
 - Differentiate between a program and a process.
 - What is system call? Write an example.
 - What do you mean by virtual memory?
 - What is belady's anomaly? Write an example.
 - What is thrashing?

2. a) Distinguish between short-term scheduler and long-term scheduler.
- b) Considering the following list of jobs, determine the CPU Gantt chart and calculate the average waiting time for each of the FCFS, Preemptive Priority, Round Robin (1 ms quantum) scheduling techniques.

Process	Burst Time (ms)	Priority	Arrival Time
P ₁	8	4	0
P ₂	6	1	2
P ₃	1	2	2
P ₄	9	2	1
P ₅	3	3	3

Calculate the CPU utilization for Round Robin (1ms Quantum) scheduling technique where context-switching overhead is 0.1 ms.

- c) Show that SJF scheduling algorithm is optimal with respect to average waiting time for a given set of processes. 2+4+2=8
3. a) What is critical section problem?
- b) What is busy waiting? Why is it useful for multiprocessor system? Briefly explain how to overcome busy waiting problem by modifying the classical definition of semaphores.
- c) State the classical readers-writers synchronization problem and solve the problem using semaphores. 1+(1+1+2)+(1+2)=8
4. a) What is resource-allocation graph? Briefly explain how it can be used to detect deadlock.
- b) Considering a system with five process P₀ through P₄ and three resource types A, B, C. Resource type A has 10 instances, type B has 5 instances and type C has 7 instances. Suppose at time t₀ following snapshot of the system has been taken:

P.T.O.

(2)

Process	Allocation	Max	Available
	A B C	A B C	A B C
P ₀	0 1 0	7 5 3	3 3 2
P ₁	2 0 0	3 2 2	
P ₂	3 0 2	9 0 2	
P ₃	2 1 1	2 2 2	
P ₄	0 0 2	4 3 3	

Answer the following questions using Banker's algorithm:

Is the system in safe state? Justify.

If Process P₁ requests one additional instance of resource type A and two instances of resource type C, can the request be granted immediately? Justify.

- c) Consider two concurrently running process: P₁ with statement S₁ and P₂ with statement S₂. Suppose we require that S₂ be executed only after S₁ has completed. How do you implement this scheme using semaphores? 3+3+2=8
5. a) Why are segmentation and paging sometimes combined into one scheme?
- b) A system implements a paged virtual address space for each process using a one-level page table. The maximum size of virtual address space is 8 MB. The page size is 1 KB and the maximum physical memory size of the machine is 1 MB. What is the maximum number of entries in a page table? How many bits are there in a virtual address? Suppose the page table for a running process includes the following entries:

Page No.	Frame No.
0	4
1	3
2	2
3	7
4	5

To which physical address the virtual address 1039 translate to? Which virtual address will translate to physical address 3075?

- c) What is locality of reference? 2+4+2=8
6. a) Find the page reference string for the following logical addresses generated by the CPU in a time span. Assume that addresses are all in decimal and page size is 1000 bytes.
7000, 325, 1010, 2123, 2025, 20, 3034, 40, 70, 2011, 3110, 20, 3037, 3057, 2040, 1010, 2105, 620, 1030, 7042, 17, 1095, 1023, 1050.
Show the contents of the frames after each page reference, assuming the LRU and optimal page-replacement algorithms are used with three page frames. How many page fault occurs in each case?
- b) Suppose that the disk request queue contains requests for sectors on the following cylinders: 50, 100, 200, 150, 30, 70, 300, 400, 500. In which order will the requests be handled under SSTF disk head scheduling algorithms by assuming that the current position of the disk arm is over the cylinder 150. Calculate the total head movement. (1+2+2)+(1+2)=8
7. Write short notes on **any two** of the following : 2×4=8
- a) Process control b) Interprocess communication
c) Multi-threaded process d) FAT 32 file system