B3.4-R3: OPERATING SYSTEMS

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) What are the basic functions of an operating system?
b) Differentiate between monitor mode and user mode with respect to protection (security) in a computer system.
c) Explain Peterson's solution for avoiding race condition.
d) Explain in detail the structure of PCB.
e) What is a thread? How are thread implemented in Kernel mode?
f) What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?
g) List four modules of an operating system and explain in detail of functionality of each module.

(7x4)

2.

a) Suppose that a disk drive is currently serving a request at cylinder 11. The queue of pending requests in FIFO order is 98, 183, 37, 122, 14, 124, 65 and 67. Starting from the current head position, what is the total distance that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithm?
i) FCFS ii) SSTF iii) SCAN/Elevator
b) Distinguish between internal and external fragmentation. Provide any two solutions to avoid external fragmentation.
c) What is a Deadlock? How can it be prevented?

(9+5+4)

3.

a) Consider a 'claim matrix', an 'allocation matrix' and a 'available vector' for a set of processes.

	Claim Matrix				**Allocation Matrix**			**Available Vector**		
	R1	R2	R3		R1	R2	R3	R1	R2	R3
P1	3	2	2	P1	1	0	0	1	1	2
P2	6	1	3	P2	5	1	1			
P3	3	1	4	P3	2	1	1			
P4	4	2	2	P4	0	0	2			

Answer the following questions using the Banker's algorithms:

i) What are the maximum units of all resources?
ii) What are the contents of the matrix need?
iii) Is the system in a safe state?
iv) A resource request for one of the processes is given. For example, if process P3 request 1 unit of R3, is this request be granted? If yes, give a <sequence> in which all processes can run to completion.

b) What is a semaphore? Which are operations done on semaphore? Give implementation of producer-consumer problem with bounded buffer using semaphore.

c) What is the difference between system call and system program.

(10+6+2)

4.

a) Explain contiguous allocation and linked list allocation for implementing file storage.

b) What are the various layers of I/O software? Explain the function of each layer.

c) What are the advantages of a Distributed File System over a file system in a centralized system?

(6+6+6)

5.

a) Draw and explain a process state transition diagram with one suspended state.

b) Discuss swapping in brief. How does buddy system speed up merging when process swaps out?

c) Consider the following set of processes in order P1, P2, P3, P4 and P5 with the length of the CPU burst time given in milliseconds. Their priorities are 3,5,2,1 and 4 respectively, with 5 being the highest priority, calculate average waiting time and turn-around time using following scheduling algorithms.

(1) Shortest Remaining Time First (2) Round Robin (q=2)

(3) Shortest Job First (4) Priority Scheduling (Preemptive)

Process	**Arrival Time**	**Burst Time**
P1	0	10
P2	1	9
P3	2	6
P4	3	7
P5	4	4

(5+5+8)

6.

a) Explain the protection domain in UNIX.

b) Discuss interleaving in brief. How does DMA increase system concurrency?

c) How long does it take to load 64 Kbyte program from a disk whose average seek time is 10 msec, rotation time is 10 msec and track holds 32 Kbytes. Calculate time when page size is 2 Kbyte and also when page size is 4 Kbyte. Assume that pages are spread around the disk and no two pages are on the same cylinder.

d) What information is saved and restored during a context switch?

(6+6+4+2)

7.

a) What is a page fault? What are the steps to be followed by operating system after occurring page fault?

b) Explain the following terms:

i) Spooling
ii) Belady's Anomaly
iii) Priority Inversion Problem
iv) Shared Pages

c) Explain architecture of UNIX Operating System.

(6+8+4)