C0-R4.B2: OPERATING SYSTEM

NOTE:

1. **Answer question 1 and any FOUR from questions 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) Discuss the differences between Page and Segment. Explain with an example.
b) What is a Process Control Block? List six pieces of information stored in it.
c) State the goals of each of the four basic subsystems of an Operating System.
d) Define the Term "Overlay", with an example.
e) Discuss the advantages and disadvantages of indexed file allocation and sequential file allocation Strategy.
f) What is the role of a device driver in an Operating System?
g) Discuss Dining philosopher problem and give solution using semaphore.

(7x4)

2.

a) Explain how protection is provided for the hardware resources by the operating system.
b) Draw a neat diagram showing structure of an Operating System. Differentiate between system calls and system programs.

(9+9)

3.

a) What is a Thread? Why is it called a light weight process? Give an example of a common function in word processor, which is accomplished by a thread.
b) What is a critical section? How can race condition arise because of critical section?
c) Explain what semaphores are, their usage, implementation given to avoid busy waiting and binary semaphores.

(6+6+6)

4. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

	Process	Burst Time	Priority
1.	*P*1	10	3
2.	*P*2	1	1
3.	*P*3	2	3
4.	*P*4	1	4
5.	*P*5	5	2

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

a) Draw four Gantt charts illustrating the execution of these processes using FCFS,SJF,A non preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.
b) What is the turnaround time of each process for each of the scheduling algorithms in **Part a)**?
c) What is the waiting time of each process for each of the scheduling algorithms in **Part a)**?
d) Which of the schedules in **Part a)** results in the minimal average waiting time (over all processes)?

(4+4+4+6)

5. Consider the following snapshot of a system:

Process	*Allocation*	*Max*	*Available*
	A B C D	*A B C D*	*A B C D*
*P*0	0 0 1 2	0 0 1 2	1 5 2 0
*P*1	1 0 0 0	1 7 5 0	
*P*2	1 3 5 4	2 3 5 6	
*P*3	0 6 3 2	0 6 5 2	
*P*4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm:

a) What is the content of the matrix *Need*? Is the system in a safe state?

b) If a request from process P1 arrives for (0, 4, 2, 0), can the request be granted immediately?

(9+9)

6. A page-replacement algorithm should minimize the number of page faults. We can do this minimization by distributing heavily used pages evenly over all of memory, rather than having them compete for a small number of page frames. We can associate with each page frame a counter of the number of pages that are associated with that frame. Then, to replace a page, we search for the page frame with the smallest counter.

a) Define a page-replacement algorithm using this basic idea. Specifically address the problems of (1) what the initial value of the counters is, (2) when counters are increased, (3) when counters are decreased, and (4) how the page to be replaced is selected.

b) How many page faults occur for your algorithm for the following reference string, for four page frames?

1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2.

c) What is the minimum number of page faults for an optimal page-replacement strategy for the reference string in **Part b)** with four page frames?

(9+5+4)

7. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving 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, 948, 1509, 1022, 1750, 130

Starting from the current head position, what is the total distance ((in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling-

a) SCAN

b) LOOK

c) C-SCAN

(6x3)