

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY,
C.S.J.M. UNIVERSITY, KANPUR**

Operating System (CSE-S 206)

B.Tech-CSE-2K22

Semester- 2023-2024 (Even Semester)

Year: II-Year, IV Semester

End Semester Examination, 08/05/2024, Shift-(02:00PM-05:00 PM)

Time: 03:00 hours

Maximum Marks: 50

Note: All questions are compulsory.

Important: Attempt questions section wise and in order.

Mention correct question number with every answer you attempt

Section A

This section is of 10 marks (10 Questions of 1 mark each)

1. The Shortest Job First (SJF) algorithm always results in the minimum average waiting time.
2. Deadlock occurs when two or more processes are unable to proceed because each is waiting for the other to release a resource.
3. Virtual memory allows a process to execute even if it is not completely in the main memory.
4. The File System Interface provides a uniform method for programs to manipulate files without having to know the underlying device details.
5. I/O interfaces are designed to abstract the differences in hardware devices, allowing software to interact with devices in a consistent manner.
6. The round-robin CPU scheduling algorithm provides a guaranteed response time for each process.
7. Deadlock prevention is preferable to deadlock avoidance in terms of system performance.
8. Thrashing in virtual memory occurs when the system spends more time swapping pages in and out of memory than executing processes.
9. The File Control Block (FCB) contains information about a file's location, size, type, and access permissions.
10. Direct Memory Access (DMA) allows I/O devices to transfer data directly to and from the main memory without involving the CPU.

Section B

This section is of 20 marks (05 Questions of 04 mark each)

11. What are the essential conditions for deadlock to occur in a system, and how can it be prevented?
12. Explain the concept of virtual memory and its benefits in modern computing systems. Also illustrate the conditions that can be benefited by virtual memory.

13. How does the File System Interface simplify file management operations for applications?
14. What factors contribute to thrashing in virtual memory systems, and how can it be mitigated?
15. Describe the role of Direct Memory Access (DMA) in improving the efficiency of data transfer between I/O devices and memory.

Section C

This section is of 20 marks (02 Questions of 10 mark each)

16. Given the architecture of 32 bits and 64 bits, equipped with 4 GB and 8 GB of RAM, respectively, determine and classify main memories that are suitable and not suitable (virtual memory concept required). Note that you have to vary the memory size from 512 GB to 2TB.

17. If an OS uses the Banker's algorithm for deadlock avoidance when managing the allocation of three resource types, X , Y , and Z , to three processes, P_0 , P_1 , and P_2 . The table given below presents the current system state. Here, the Allocation matrix shows the current number of resources of each type allocated to each process, and the Max matrix shows the maximum number of resources of each type required by each process during its execution.

	Allocation			Max		
	X	Y	Z	X	Y	Z
P_0	0	0	1	8	4	3
P_1	3	2	0	6	2	0
P_2	2	1	1	3	3	3

Available: $(X, Y, Z) = (3, 2, 2)$

Request1 (P_0) : $(X, Y, Z) = (0, 0, 2)$

Request2 (P_1) : $(X, Y, Z) = (2, 0, 0)$

Explain whether the system is in a safe state and whether Request1 and Request2 can be granted or not,

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Subject- Operating Systems (CSE-5206) CSE(2K22Batch)

Semester- 2023-2024 (Even Semester)

Year: II Year, Semester IV

Second Mid Semester Examination, 22/03/24, Shift-2nd 11:00 AM – 12:30 PM

Maximum Marks: 30

Time: 1:30 hours

Note: All questions are compulsory.

Section A

Each question in this section carries 01 marks

A. Fill in the blanks.

1. While selects which process should be executed next and allocates CPU, selects which processes should be brought into the ready queue.
2. If the parent terminated without invoking **wait**, the process is an and, if no parent waiting (did not invoke **wait ()**) process is a
3. Blocking and non-blocking message-passing techniques are often categorized as and modes of synchronization.
4. Deadlocks occur primarily due to which is often done after
5. In multiprocessor scheduling attempts to keep workload evenly distributed.

B. Comment if the following statements are true or false.

1. The round-robin CPU scheduling algorithm is designed to be fair by allocating an equal amount of CPU time to each process in the ready queue, promoting fairness among processes.
2. A process in execution may receive an interrupt, go to the waiting state, and then directly return to execution after the interrupt is handled.
3. In inter-process communication using message passing, synchronous communication always guarantees that the sender and receiver processes are executing concurrently.
4. Deadlock detection algorithms identify the presence of deadlocks in the system by periodically checking for the existence of a cycle in the resource allocation graph.

Section B

Each question in this section carries 03 marks

1. Describe any three scenarios that lead to deadlocks.
2. Describe methods that enable inter-process communication.
3. The ready queue given below is to be scheduled via priority scheduling. Find the average waiting time.

P_8^1	P_7^3	P_6^1	P_5^3	P_4^2	P_3^2	P_2^3	P_1^2
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Note for question 3 of section B: The sub-script number denotes the process number while the super-script number denotes the priority order.

Section C

Each question in this section carries 06 marks

1. Consider a system with four threads (T_1, T_2, T_3, T_4) and four resources (R_1, R_2, R_3, R_4) such that each Thread T_i controls the corresponding resource R_i . This way, each thread requires access to one resource at a time and will release the resource after its execution. The following deadlock-prone sequence is observed:

- i) T_1 requests R_2
- ii) T_2 requests R_3
- iii) T_3 requests R_4
- iv) T_4 requests R_1

(a) Identify the sequence of events that led to the deadlock in the system.

(b) Propose a method to prevent deadlocks in the given scenario.

(c) Discuss the advantages and disadvantages of the method proposed in (b).

2. Consider five processes in the ready queue as shown in Table 1. Based on this, compute the average waiting delay/time for the following scenarios:

- a. First come first serve (FCFS)
- b. Shortest job first (SJF)
- c. Shortest remaining time first if after every two dispatches (each with time 'd') one process must be executed.
- d. Round-robin with time quantum = 3

Table 1: Process execution time

Process	Execution time (in ms)
P_1	4
P_2	13
P_3	8
P_4	5
P_5	3