Unit:IV

5 Marks Questions

1. Define deadlock. Provide a real-world example to illustrate it.
2. List and explain the necessary conditions for a deadlock to occur.
3. What is a Resource Allocation Graph (RAG)? How is it used to detect deadlocks?
4. Explain the concept of a safe state in deadlock avoidance.
5. Differentiate between deadlock prevention and deadlock avoidance.

10 Marks Questions

6. Discuss the Resource Allocation Graph Algorithm for deadlock avoidance with an example.
7. Explain the Banker's Algorithm. Use an example to show how it determines if a system is in a safe state.
8. Describe the methods for handling deadlocks and evaluate their practicality.
9. A system has three processes (P1, P2, P3) and three resource types (R1, R2, R3).
   The allocation of resources is as follows:

   P1 → R1, P2 → R2, P3 → R3.

Draw the Resource Allocation Graph (RAG) and determine if a deadlock exists.

10. Consider a system with:

- Processes: P1, P2
- Resources: R1, R2 (each with one instance).
  Allocation: P1 → R1, P2 → R2
  Request: P1 → R2, P2 → R1
  Draw the RAG and check if a cycle exists. Is the system in a deadlock?

15 Marks Questions

1. Explain the Banker's Algorithm in detail and demonstrate its working with a complete numerical example.
2. Analyze the differences between deadlock prevention, deadlock avoidance, and deadlock detection. Which approach is the most practical, and why?
3. Describe in detail how a deadlock can occur in a system, including all necessary conditions and an example involving multiple processes and resources.

4. **Use the safety algorithm to test if the system is in a safe state or not? Create the need matrix using the following table.**

Given Matrices												
	Allocation Matrix (N0 of the allocated resources By a process)				**Max Matrix Max resources that may be used by a process**				**Available Matrix Not Allocated Resources**			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
P_0	0	1	1	0	0	2	1	0	1	5	2	0
P_1	1	2	3	1	1	6	5	2				
P_2	1	3	6	5	2	3	6	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				
Total	**2**	**12**	**14**	**12**								

5. Consider a system with 5 processes (P1, P2, P3, P4, P5) and 3 resource types (R1, R2, R3). Each resource type has the following total number of instances:

R1: 7 instances

R2: 2 instances

R3: 6 instances

The **current allocation** and **requested resources** by processes are given as follows:

Process	Allocated R1	Allocated R2	Allocated R3	Request R1	Request R2	Request R3
P1	2	0	1	3	0	2
P2	1	1	2	1	1	2
P3	2	0	3	2	1	1
P4	3	1	0	0	0	1
P5	0	0	0	2	0	0

Tasks:

1. **Draw the Resource Allocation Graph (RAG)** with processes (P1 to P5) and resources (R1, R2, R3), showing the current allocation and requests.
2. **Determine if the system is in a deadlock state**. If yes, identify the processes involved in the deadlock.

3. **If not in deadlock**, evaluate the system's state (safe or unsafe).

Unit V

5-Mark Questions

1. Memory Protection:
   Explain the importance of memory protection in operating systems. Name two hardware mechanisms used for memory protection.
2. Address Binding:
   What are the three stages of address binding? Provide a brief explanation of each stage.
3. Logical vs Physical Address:
   Differentiate between logical and physical address spaces in a virtual memory system.
4. Contiguous Memory Allocation:
   Define internal and external fragmentation. How does compaction help reduce fragmentation?
5. Page Fault:
   What is a page fault? List two conditions that can cause a page fault to occur.

10-Mark Questions

1. **First Fit, Best Fit, and Worst Fit**:
   Consider memory partitions of sizes 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB. Allocate processes of sizes 212 KB, 417 KB, 112 KB, and 426 KB using **First Fit**, **Best Fit**, and **Worst Fit** strategies. Show the allocation step-by-step.
2. **Paging and Page Tables**:
   Describe the role of a page table in a paging system. Explain how hierarchical and inverted page tables differ in structure and usage.
3. **Belady's Anomaly**:
   What is Belady’s Anomaly? Demonstrate with an example how it occurs in FIFO page replacement.
4. **Virtual Memory**:
   Explain the concept of virtual memory. How does demand paging enable the efficient use of virtual memory?

5. **Buddy System**:
   Explain the buddy system of memory allocation with an example. How does it minimize fragmentation compared to contiguous allocation strategies?

15-Mark Questions

1. **Page Replacement Algorithms**:
   Given the page reference string: **1, 3, 0, 3, 5, 6, 3, 1, 4, 2, 3, 1, 0, 4, 6**, simulate the following algorithms for 3 frames:
   - FIFO
   - LRU
   - Optimal Page Replacement
     Calculate the number of page faults for each algorithm.
2. **Segmentation vs Paging**:
   Compare and contrast segmentation and paging. Explain how segmentation with paging combines the benefits of both techniques with an example.
3. **Thrashing**:
   What is thrashing in a virtual memory system? Explain the causes and strategies to mitigate thrashing with examples.
4. **Demand Paging and Page Fault Handling**:
   Describe the steps involved in handling a page fault in demand paging. How do page replacement policies affect system performance?
5. **Memory Management Strategies**:
   Compare static and dynamic contiguous memory allocation methods. Discuss the pros and cons of the **Best Fit**, **First Fit**, and **Worst Fit** strategies with practical scenarios.

Unit-VI

5-Mark Questions

1. **File Attributes**:
   What are file attributes? List at least five common attributes of a file and their purposes.
2. **File Access Methods**:
   Differentiate between sequential access and direct access methods for files.
3. **Directory Logical Structures**:
   Describe the single-level directory structure. What are its advantages and disadvantages?
4. **Disk Allocation**:
   Explain how linked allocation works in disk management. What is its main advantage?

5. **Disk Scheduling Algorithms**:
   What is the primary goal of disk scheduling? Name two algorithms commonly used for disk scheduling.

10-Mark Questions

1. **File Operations**:
   Explain the primary operations that can be performed on files. Provide examples for each operation.
2. **Directory Structures**:
   Compare the tree-structured directory with the acyclic graph directory structure. What are the advantages of using an acyclic graph structure?
3. **Free Space Management**:
   Discuss the role of free space management in file systems. Compare the bit map and linked list approaches for managing free space.
4. **Disk Allocation Methods**:
   Explain the contiguous and indexed disk allocation methods. Discuss the advantages and disadvantages of each.
5. **Disk Scheduling - Example**:
   Consider a disk with request queue: **98, 183, 37, 122, 14, 124, 65, 67**. The disk head is currently at **53**, and the disk has **200 cylinders (0-199)**.
   Compute the total head movement for the following algorithms:
   - FCFS
   - SSTF
   - SCAN

15-Mark Questions

1. **File System Structure**:
   Explain the file system structure, focusing on the roles of the following layers:
   - File Control Block (FCB)
   - Directory Management
   - Space Management
     Use a diagram to illustrate the structure.

2. **Directory and File Access**:
   Describe the hierarchical directory structure. Explain how pathnames are used to access files and the advantages of absolute and relative pathnames.

3. **Disk Scheduling Algorithms - Analysis**:
   Given the disk request sequence: **176, 79, 34, 60, 92, 11, 41, 114** and an initial head position of **50**, calculate and compare the total head movement for:

   - FCFS
   - LOOK
   - C-LOOK
     Discuss the scenarios where LOOK or C-LOOK performs better than FCFS.

4. **Free Space Management and Fragmentation**:
   Compare the bit vector, linked list, and grouping approaches for free space management. Explain how they handle fragmentation in disk systems.

5. **Indexed Allocation**:
   Explain how indexed allocation works with the help of an example. Compare it with contiguous and linked allocation in terms of performance and space utilization.