Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface- File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure -Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

Question Bank – Principles of Operating Systems

(Focus Area: Mass Storage Systems & File Systems)

Aligned with MAANGO BIG7 Framework & MNC Interview Patterns

Part A: Short Answer Questions (Bloom's: Remember / Understand | Industry-Oriented)

Disk Structure & Scheduling

1. Explain the Cylinder-Head-Sector (CHS) addressing in disk storage. (Unit 4 | Bloom's: Remember | Tag: Seagate)

2. Compare SSD vs HDD in terms of access time and lifespan. (Unit 4 | Bloom's: Understand | Tag: Samsung)

3. What is Rotational Latency in disk scheduling? (Unit 4 | Bloom's: Remember | Tag: Western Digital)

4. Differentiate between SCAN and C-SCAN disk scheduling algorithms. (Unit 4 | Bloom's: Understand | Tag: Microsoft Azure)

5. How does TRIM command improve SSD performance? (Unit 4 | Bloom's: Understand | Tag: Intel)

File-System Interface

6. What are the different file access methods? Explain sequential access. (Unit 4 | Bloom's: Remember | Tag: IBM)

7. Why is inode used in Unix-based file systems? (Unit 4 | Bloom's: Understand | Tag: Apple)

8. Explain hard links vs. symbolic links with an example. (Unit 4 | Bloom's: Understand | Tag: Linux Foundation)

9. What is Journaling in File Systems and its benefits? (Unit 4 | Bloom's: Understand | Tag: Google)

10. How does File System Mounting work in Linux/Windows? (Unit 4 | Bloom's: Understand | Tag: Red Hat)

File System Implementation & I/O Systems

11. Compare Contiguous vs. Linked Allocation in file systems. (Unit 4 | Bloom's: Understand | Tag: Oracle)

12. What is the role of Free Space Bitmap in file systems? (Unit 4 | Bloom's: Remember | Tag: TCS)

13. Explain RAID Levels 0, 1, and 5 with use cases. (Unit 4 | Bloom's: Understand | Tag: Dell EMC)

14. How does Direct Memory Access (DMA) improve I/O operations? (Unit 4 | Bloom's: Understand | Tag: NVIDIA)

15. What are Device Drivers and why are they essential? (Unit 4 | Bloom's: Remember | Tag: Intel)

Part B: Long Answer Questions (Bloom's: Apply / Analyze / Evaluate | Real-World Scenarios)

Disk Scheduling & Management

1. Compare FCFS, SSTF, and LOOK disk scheduling algorithms for a database server workload. (Bloom's: Analyze | Unit 4 | Tag: Amazon RDS)

2. Design a hybrid storage solution using SSDs for caching and HDDs for archival. (Bloom's: Apply | Unit 4 | Tag: NetApp)

3. Case Study: A cloud provider faces high disk I/O latency. Recommend optimizations using scheduling and caching. (Bloom's: Evaluate | Unit 4 | Tag: Google Cloud)

4. Evaluate the impact of disk fragmentation on performance and propose solutions. (Bloom's: Evaluate | Unit 4 | Tag: Microsoft)

5. Explain how ZFS combines file system and volume management for data integrity. (Bloom's: Analyze | Unit 4 | Tag: Oracle)

File-System Interface & Implementation

6. Analyze NTFS vs. ext4 in terms of scalability, security, and recovery. (Bloom's: Analyze | Unit 4 | Tag: Microsoft)

7. Design a secure file-sharing system for a corporate network with ACLs. (Bloom's: Apply | Unit 4 | Tag: Infosys)

8. Case Study: A file server crashes frequently due to inode exhaustion. Diagnose and fix the issue. (Bloom's: Evaluate | Unit 4 | Tag: Wipro)

9. Compare FAT32, exFAT, and NTFS for USB drives in terms of compatibility and limits. (Bloom's: Analyze | Unit 4 | Tag: SanDisk)

10. Reverse Engineer a file recovery tool and explain how it retrieves deleted files. (Bloom's: Apply | Unit 4 | Tag: Kroll Ontrack)

I/O Systems

11. Explain how modern OSes handle asynchronous I/O (e.g., AIO in Linux, IOCP in Windows). (Bloom's: Analyze | Unit 4 | Tag: IBM)

12. Case Study: A video streaming app (like Netflix) faces buffering issues. Optimize I/O scheduling for better throughput. (Bloom's: Evaluate | Unit 4 | Tag: Netflix)

13. Evaluate the role of Interrupts vs. Polling in high-performance storage systems. (Bloom's: Evaluate | Unit 4 | Tag: NVIDIA)

14. Design an I/O scheduler for a real-time database system. (Bloom's: Create | Unit 4 | Tag: MongoDB)

15. Case Study: An IoT device has limited RAM but high I/O demands. Propose a lightweight I/O stack. (Bloom's: Evaluate | Unit 4 | Tag: ARM)

Part C: Case-Based/Design-Based Questions (Bloom's: Analyze / Evaluate / Create | Industry Problem-Solving)

1. Case Study: A banking app requires atomic writes and crash consistency. Design a file system with journaling/COW. (Bloom's: Create | Unit 4 | Tag: JPMorgan Chase)

2. Optimize a file system for a video surveillance system (high writes, rare deletes). (Bloom's: Evaluate | Unit 4 | Tag: Hikvision)

3. Case Study: A social media platform (like Instagram) needs fast metadata operations. Recommend a file system (e.g., ext4, XFS, ZFS). (Bloom's: Analyze | Unit 4 | Tag: Meta)

4. Design a fault-tolerant storage system using RAID and replication for a cloud backup service. (Bloom's: Create | Unit 4 | Tag: AWS)

5. Case Study: An autonomous vehicle OS needs predictable I/O latency. Propose an I/O subsystem design. (Bloom's: Evaluate | Unit 4 | Tag: Tesla)

📌 Key Features of Question Bank:

✓ Covers Disk Scheduling, File Systems, I/O Systems

✓ Bloom's Taxonomy Balanced (Remember → Create)

✓ Real-World MNC Case Studies (AWS, Meta, Netflix, etc.)

✓ Interview-Aligned (Cloud Storage, File Systems, High-Performance I/O)

✓ Difficulty Level: Moderate (Engineering Students Focused)

This Question Bank ensures industry relevance, problem-solving skills, and technical depth for Placement & Higher Studies. Let me know if you need modifications! 🚀