QUESTION BANK

OPERATING SYSTEM

Electronics and Communication Department

BABA BANDA SINGH ABAHDUR ENGINEERING COLLEGE , FATEHGARH SAHIB, PUNJAB

Question Bank

Subject: Operating System **Semester: 6th**

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MODULE 1: INTRODUCTION

2 Marks Questions

1. Define an Operating System.
2. What are the main functions of an Operating System?
3. Name the different generations of Operating Systems.
4. What is a system call?
5. Define a Virtual Machine.
6. List any two types of Operating Systems.
7. What is a Monolithic OS?
8. Give an example of a Microkernel-based OS.
9. Mention two OS services.
10. What is the purpose of the Kernel in an OS?

4 Marks Questions

1. Explain the different types of Operating Systems.
2. Describe the services provided by an Operating System.
3. Differentiate between Monolithic and Microkernel OS.
4. Explain the concept of a Virtual Machine with an example.
5. What are system calls? Explain their types.
6. Discuss the structure of an Operating System with suitable diagrams.
7. Compare and contrast UNIX and WINDOWS Operating Systems.
8. Explain the role of system calls in process management.
9. Describe the layered architecture of an Operating System.
10. What are the advantages and disadvantages of a Microkernel-based OS?

8 Marks Questions

1. Explain in detail the generations of Operating Systems with examples.
2. Describe the different types of Operating Systems and their applications.
3. Discuss the various services provided by an Operating System and their significance.
4. Explain system calls in detail with examples and their role in OS.
5. Compare UNIX and WINDOWS Operating Systems based on architecture, features, and functionalities.
6. What is a Virtual Machine? Explain its working, advantages, and disadvantages.
7. Explain different structures of an Operating System with proper examples.
8. Discuss the advantages and disadvantages of Layered, Monolithic, and Microkernel OS.
9. Describe the role of an Operating System in managing hardware and software resources.
10. Explain the evolution of Operating Systems from early generations to modern OS.

MODULE 2: PROCESSES

2 Marks Questions

1. Define a process.
2. What is a Process Control Block (PCB)?
3. Name the different states of a process.
4. What is context switching?
5. Define a thread.
6. Mention two benefits of threads.
7. What is multithreading?
8. Name any two types of schedulers.
9. What is CPU utilization?
10. Differentiate between preemptive and non-preemptive scheduling.

4 Marks Questions

1. Explain the process state transition diagram.
2. Describe the components of a Process Control Block (PCB).
3. Compare a process and a thread.
4. What are the various states of a thread? Explain briefly.
5. Discuss the advantages of multithreading.
6. Explain the objectives of process scheduling.
7. What are the different types of process schedulers?
8. Compare FCFS and SJF scheduling algorithms with examples.
9. Describe the concept of Round Robin (RR) scheduling with an example.
10. Explain the scheduling criteria used in process scheduling.

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8 Marks Questions

1. Explain the different states of a process with a state transition diagram.
2. What is a Process Control Block (PCB)? Explain its structure and significance.
3. Discuss the concept of context switching and its impact on system performance.
4. Explain different types of threads and their advantages.
5. Compare and contrast preemptive and non-preemptive scheduling techniques.
6. Explain various scheduling algorithms (FCFS, SJF, RR) with examples.
7. What is multiprocessor scheduling? Explain its challenges and benefits.
8. Describe real-time scheduling techniques RM (Rate Monotonic) and EDF (Earliest Deadline First).
9. Discuss different scheduling criteria and their impact on process performance.
10. Explain the working of Round Robin (RR) scheduling with a detailed example.

MODULE 3: INTER-PROCESS COMMUNICATION (IPC)

2 Marks Questions

1. What is Inter-Process Communication (IPC)?
2. Define a critical section.
3. What is a race condition?
4. What do you mean by mutual exclusion?
5. Name any two hardware solutions for mutual exclusion.
6. What is Peterson's solution?
7. Define semaphores.
8. What is the Producer-Consumer problem?
9. What is message passing in IPC?
10. List two classical IPC problems.
11. What are event counters?
12. Define the term "monitor" in process synchronization.
13. What is a deadlock in IPC?
14. Name two methods of IPC.
15. What is strict alternation in process synchronization?

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4 Marks Questions

1. Explain the concept of a critical section and race conditions.
2. Describe mutual exclusion and its importance in process synchronization.
3. What is Peterson's solution? Explain how it ensures mutual exclusion.
4. Describe the Producer-Consumer problem with an example.
5. Explain how semaphores are used for process synchronization.
6. Compare message passing and shared memory methods in IPC.
7. Discuss the role of monitors in process synchronization.
8. Explain the Reader-Writer problem and how it is solved.
9. Describe the Dining Philosopher's Problem and its significance in synchronization.

10. Explain event counters and their role in IPC.
11. What are the advantages and disadvantages of message passing?
12. Explain the concept of busy waiting in process synchronization.
13. Discuss strict alternation and its limitations in ensuring mutual exclusion.
14. What is a deadlock? Explain with an example.
15. Compare synchronous and asynchronous message passing in IPC.

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8 Marks Questions

1. What is a race condition? Explain with an example and how it can be prevented.
2. Describe mutual exclusion and discuss different solutions to achieve it.
3. Explain the concept of semaphores with their types and operations.
4. Discuss the Producer-Consumer problem and its solution using semaphores.
5. Compare and contrast Peterson's solution and strict alternation method for mutual exclusion.
6. Explain classical IPC problems (Readers-Writers and Dining Philosophers) with their solutions.
7. Describe hardware solutions for achieving mutual exclusion.
8. Explain message passing in IPC and compare synchronous vs asynchronous communication.
9. Discuss the working of monitors and how they help in process synchronization.
10. Explain the concept of event counters and their usage in inter-process communication.
11. Discuss the role of deadlocks in IPC and strategies to prevent them.
12. Explain how semaphores and monitors differ in handling process synchronization.
13. What are the challenges of IPC in a distributed system?
14. Describe the working of the Dining Philosopher's problem and solutions to avoid deadlocks.
15. Compare and contrast the various synchronization mechanisms used in IPC.

MODULE 4: DEADLOCKS

2 Marks Questions

1. What is a deadlock?
2. List the four necessary conditions for deadlock.
3. What is mutual exclusion in the context of deadlocks?
4. Define hold and wait condition.
5. What is circular wait?
6. What is the difference between deadlock prevention and deadlock avoidance?
7. Name one deadlock prevention technique.
8. What is the basic idea behind Banker's Algorithm?
9. How does a system detect a deadlock?
10. What is resource allocation graph (RAG)?
11. What is safe state in deadlock avoidance?
12. Define deadlock recovery.
13. What is the role of preemption in deadlock handling?
14. Name two methods of deadlock recovery.
15. What is a wait-for graph in deadlock detection?

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4 Marks Questions

1. Explain the necessary and sufficient conditions for a deadlock to occur.
2. Discuss the difference between deadlock prevention and deadlock avoidance.
3. How does mutual exclusion contribute to deadlocks?
4. Explain how circular wait leads to deadlock with an example.
5. Describe the steps involved in Banker's Algorithm.
6. Explain the concept of safe and unsafe states in deadlock avoidance.
7. How does a system detect a deadlock? Explain with an example.
8. What are the different ways to recover from a deadlock?
9. Discuss the limitations of deadlock detection and recovery techniques.
10. Explain how resource allocation graphs (RAG) help in detecting deadlocks.

11. How can preemption help in deadlock recovery?
12. What are the disadvantages of deadlock prevention techniques?
13. Describe how a wait-for graph is used in deadlock detection.
14. Explain the role of resource allocation policies in avoiding deadlocks.
15. Compare deadlock detection, prevention, and avoidance techniques.

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8 Marks Questions

1. Explain the four necessary and sufficient conditions for a deadlock with examples.
2. Discuss deadlock prevention techniques with advantages and disadvantages.
3. Explain Banker's Algorithm with an example and step-by-step calculations.
4. How does a system detect deadlocks? Explain the various methods.
5. Describe the methods used for deadlock recovery.
6. Explain how preemption-based recovery works and its limitations.
7. Discuss the concept of safe and unsafe states in deadlock avoidance with examples.
8. Compare and contrast deadlock avoidance and deadlock detection.
9. How can resource allocation graphs (RAG) be used to detect and prevent deadlocks?
10. Discuss various approaches to handle deadlocks in operating systems.
11. Explain circular wait condition with an example and a method to break it.
12. Discuss the impact of deadlocks on system performance and ways to mitigate them.
13. What are the practical challenges in implementing deadlock handling techniques?
14. Explain the working of the wait-for graph with an example.
15. Compare deadlock avoidance strategies used in different real-world operating systems.

MODULE 5: MEMORY MANAGEMENT

2 Marks Questions

1. What is memory management in an operating system?
2. Define logical and physical addresses.
3. What is contiguous memory allocation?
4. Differentiate between fixed and variable partitioning.
5. What is internal fragmentation?
6. What is external fragmentation?
7. How does compaction help in memory management?
8. Define paging in memory management.
9. What is page allocation?
10. List two advantages of paging.
11. What is the purpose of hardware support in paging?
12. What is virtual memory?
13. Define a page fault.
14. What is the locality of reference?
15. What is a dirty page or dirty bit?
16. What is demand paging?
17. Name two page replacement algorithms.
18. What is the FIFO page replacement algorithm?
19. Define the Least Recently Used (LRU) page replacement algorithm.
20. What is the working set in virtual memory?

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4 Marks Questions

1. Differentiate between logical and physical addresses with an example.
2. Explain internal and external fragmentation with suitable examples.
3. Describe the difference between fixed and variable partitioning.
4. How does compaction reduce external fragmentation?
5. Explain the concept of paging with an example.

6. What are the advantages and disadvantages of paging?
7. Discuss the role of hardware support in paging.
8. Explain the concept of virtual memory and its advantages.
9. What is demand paging? Explain with an example.
10. Describe the steps involved in handling a page fault.
11. Explain the principle of locality of reference and its significance in memory management.
12. What is a dirty bit in memory management? Why is it important?
13. Compare different page replacement algorithms (FIFO, LRU, and Optimal).
14. Explain the working of the Second-Chance (SC) page replacement algorithm.
15. How does the Not Recently Used (NRU) page replacement algorithm work?

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8 Marks Questions

1. Explain the concept of logical and physical address space in detail.
2. Describe contiguous memory allocation and discuss its advantages and disadvantages.
3. Discuss different types of fragmentation and their impact on system performance.
4. Explain the paging mechanism with hardware support and an example.
5. Compare and contrast paging and segmentation.
6. Discuss virtual memory in detail, including hardware and control structures.
7. Explain demand paging and how it re
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9. duces memory wastage.
10. Describe page faults and explain the steps taken to handle them.
11. Explain the concept of the working set model in virtual memory management.
12. Describe the FIFO, LRU, and Optimal page replacement algorithms with examples.
13. Explain the Second Chance and Not Recently Used (NRU) page replacement algorithms in detail.
14. Discuss the impact of page replacement algorithms on system performance.
15. How does the locality of reference influence virtual memory performance?
16. Explain the advantages and disadvantages of virtual memory.

Module 6

I/O Hardware, File Management & Disk Management

2 Marks Questions

1. What is an I/O device?
2. Define Direct Memory Access (DMA).
3. What are the goals of interrupt handlers?
4. Define a device driver.
5. What is device-indepe ndent I/O software?
6. What is a file system?
7. Name two types of file access methods.
8. What are the different file types?
9. List any two file operations.
10. What is a directory structure?
11. What is a contiguous file allocation method?
12. Define linked file allocation.
13. What is indexed file allocation?
14. What is free space management in file systems?
15. What are the different methods for free space management?
16. Define disk scheduling.
17. Name two disk scheduling algorithms.
18. What is FCFS disk scheduling?
19. What is disk formatting?
20. Define bad blocks in disk management.

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4 Marks Questions

1. Explain the role of device controllers in I/O hardware.
2. Describe the working of Direct Memory Access (DMA) with an example.
3. Explain the role and importance of interrupt handlers in an operating system.

4. What is a device driver? How does it interact with hardware?
5. Discuss the advantages of device-independent I/O software.
6. Explain the different file access methods with examples.
7. What are the major file operations? Explain each briefly.
8. Explain the directory structures and their importance in file systems.
9. Compare and contrast contiguous, linked, and indexed allocation methods.
10. How is free space managed in file systems? Explain different techniques.
11. Describe the disk structure and its significance in secondary storage.
12. Explain the FCFS and SSTF disk scheduling algorithms with examples.
13. How does the SCAN disk scheduling algorithm work?
14. Compare SCAN and C-SCAN disk scheduling algorithms.
15. What is disk formatting? Explain its role in disk management.

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8 Marks Questions

1. Explain in detail the I/O devices and their communication with the operating system.
2. Describe the working of device controllers and their interaction with I/O devices.
3. Explain Direct Memory Access (DMA) with a diagram and its advantages.
4. Discuss the goals and working of interrupt handlers in operating systems.
5. Explain the different types of file access methods with examples.
6. Describe the various file allocation methods (contiguous, linked, and indexed) with their advantages and disadvantages.
7. Discuss file system structures and their role in an operating system.
8. Explain the different techniques for free space management in file systems.
9. Describe the disk structure and various disk scheduling algorithms with examples.
10. Compare and contrast different disk scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN).
11. Explain disk management, including disk reliability, formatting, and handling bad blocks.
12. Discuss the role of a boot block in disk management.
13. How does directory implementation impact file system efficiency and performance?

14. Describe the linear list and hash table approaches for directory implementation.
15. Compare different disk scheduling algorithms based on performance and efficiency.

Numerical Problems

1. FCFS Disk Scheduling Problem (4 Marks)

A disk has the following request queue:
98, 183, 37, 122, 14, 124, 65, 67
The disk head is currently at **53**. Calculate the total head movement using the **FCFS (First-Come-First-Serve) scheduling algorithm**.

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2. SSTF Disk Scheduling Problem (4 Marks)

Given the following request queue:
55, 58, 39, 18, 90, 160, 150, 38, 184
If the disk head starts at **50**, calculate the total head movement using the **SSTF (Shortest Seek Time First) algorithm**.

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3. SCAN Disk Scheduling Problem (8 Marks)

Consider a disk with **200 cylinders (0-199)**.
Request queue: **98, 183, 37, 122, 14, 124, 65, 67**
Head starts at **53** and moves towards **higher cylinder numbers**.
Calculate the total head movement using **SCAN scheduling algorithm**.

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4. C-SCAN Disk Scheduling Problem (8 Marks)

A disk has **200 tracks (0-199)**, and the request queue is:
86, 147, 91, 177, 94, 150, 102, 175, 130
The read/write head starts at **100** and moves towards **higher cylinder numbers**.
Calculate the total head movement using **C-SCAN scheduling**.

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5. Paging Numerical (8 Marks)

A system has a **32-bit logical address space** and a **page size of 4 KB**.

- How many **pages** are there in the logical address space?
- How many **bits** are needed for the **page number** and **page offset**?

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6. File Allocation Numerical (4 Marks)

A file consists of **6 blocks**. The **disk block size** is **1 KB**, and **each disk block pointer is 4 bytes**.

- How many disk blocks are required if the file is stored using **linked allocation**?
- How many disk blocks are required for **indexed allocation**, assuming the index block fits 256 pointers?