GUJARAT TECHNOLOGICAL UNIVERSITY

BE-4 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:
Operating System (3140702)

Unit 1: Introduction to Operating Systems – Detailed Question List

Repeated Questions:

1. **Explain the basic functions of an Operating System.**
   - **Appeared in:** S23 (Q1a, 03 marks), W22 (Q1b, 04 marks), W24 (Q1a, 03 marks), W25 (Q1a, 03 marks)
2. **Compare/Differentiate between different types of OS:**
   - Batch, Time Sharing, Real Time, Distributed, Multiprogramming, Multiprocessing, Multitasking
   - **Appeared in:** S22 (Q1b, 04 marks), S23 (Q1b, 04 marks), S25 (Q1c, 07 marks), W24 (Q1c, 07 marks), W25 (Q1b, 04 marks)
3. **Explain Process, Process States, and Process Control Block (PCB).**
   - **Appeared in:** S22 (Q1c, 07 marks), S23 (Q1c, 07 marks), W22 (Q1c, 07 marks), W24 (Q2c, 07 marks), W25 (Q1c, 07 marks)

Other Important Questions:

4. **Explain the concept of Virtual Machine and Virtualization.**
   - **Appeared in:** W24 (Q1b, 04 marks), W23 (Q1a, 03 marks), W22 (Q5b, 04 marks)
5. **Explain System Calls and their handling.**
   - **Appeared in:** W24 (Q2b, 04 marks)
6. **Explain the role of Kernel and Shell in Unix/Linux.**
   - **Appeared in:** S25 (Q3a, 03 marks)
7. **Write a shell script to find factorial of a number.**
   - **Appeared in:** S25 (Q4a, 03 marks), W23 (Q1b, 04 marks)
8. **Explain the uses of an Operating System.**
   - **Appeared in:** W25 (Q1a, 03 marks)
9. **List any four functions of an Operating System.**
   - **Appeared in:** S22 (Q1a, 03 marks)
10. **Explain Virtual Machine architecture of OS.**
    - **Appeared in:** W24 (Q1b, 04 marks)
11. **Differentiate Multiprogramming, Multitasking, Multiprocessing OS.**
    - **Appeared in:** W24 (Q1c, 07 marks)
12. **Explain time sharing, real-time, and batch operating systems in detail.**
    - **Appeared in:** S25 (Q1c, 07 marks)
13. **Explain the features of a distributed operating system.**
    - **Appeared in:** S23 (Q1b, 04 marks)

Unit 2: Process and Threads Management – Detailed Question List

Repeated Questions:

1. **Explain the concept of Threads, User-level vs Kernel-level threads, and their benefits.**
   - **Appeared in:** S22 (Q2b, 04 marks), S23 (Q2a, 03 marks), W22 (Q2a, 03 marks), W24 (Q2a, 03 marks), W25 (Q2a, 03 marks)
2. **Explain CPU Scheduling Criteria and Algorithms (FCFS, SJF, RR, Priority).**
   - **Appeared in:** S22 (Q2a, 03 marks), S23 (Q2c, 07 marks), W23 (Q2c, 07 marks), W24 (Q3c, 07 marks), W25 (Q3c, 07 marks)
3. **Explain Process State Transition Diagram (5-state / 7-state).**
   - **Appeared in:** W23 (Q1c, 07 marks), W24 (Q2c, 07 marks), W22 (Q2c, 07 marks)

Other Important Questions:

4. **Explain the role of Dispatcher.**
   - **Appeared in:** W23 (Q2a, 03 marks)
5. **Explain Preemptive vs Non-Preemptive Scheduling.**
   - **Appeared in:** S22 (Q3a, 03 marks), W24 (Q3a, 03 marks), W25 (Q3a, 03 marks)
6. **Explain Real-Time Scheduling Algorithms.**
   - **Appeared in:** W23 (Q2b, 04 marks)
7. **Explain Scheduling Criteria (Turnaround Time, Waiting Time, Throughput).**
   - **Appeared in:** S25 (Q2a, 03 marks), W25 (Q3a, 03 marks)
8. **Compare Round Robin, FCFS, and Shortest Job First Algorithms.**
   - **Appeared in:** S25 (Q2b, 04 marks)
9. **Explain the differences among Long-term, Short-term, and Medium-term scheduling.**
   - **Appeared in:** S23 (Q2b, 04 marks)
10. **Illustrate non-preemptive priority scheduling algorithm.**
    - **Appeared in:** W22 (Q2c, 07 marks)
11. **Explain types of schedulers.**
    - **Appeared in:** W22 (Q2b, 04 marks)
12. **Explain Thread Scheduling.**
    - (Indirectly covered in Threads topic)
13. **Numerical on Scheduling Algorithms (Turnaround Time, Waiting Time, Throughput).**
    - **Appeared in:** W23 (Q2c, 07 marks)

Unit 3: Concurrency – Detailed Question List

Repeated Questions:

1. **Explain Principles of Concurrency, Race Condition, Critical Section, Mutual Exclusion.**
   - **Appeared in:** S23 (Q3a, 03 marks), S22 (Q3b, 04 marks), W24 (Q3b, 04 marks), W25 (Q3b, 04 marks)
2. **Explain Semaphores (Binary, Weak vs Strong, Mutex vs Semaphore).**
   - **Appeared in:** S23 (Q2c, 07 marks), W23 (Q3a, 03 marks), W24 (Q3c, 07 marks), W25 (Q2c, 07 marks)
3. **Explain Peterson's Solution and other software/hardware approaches to Mutual Exclusion.**
   - **Appeared in:** W24 (Q2c, 07 marks)

Other Important Questions:

4. **Explain Monitors and their use in synchronization.**
   - **Appeared in:** S25 (Q2c, 07 marks), S22 (Q2c, 07 marks)
5. **Explain Pipes, Message Passing, and Signals.**
   - (Covered in IPC unit)
6. **Explain the requirements for mutual exclusion.**
   - **Appeared in:** W23 (Q3b, 04 marks)
7. **Define: Critical Section, Mutual Exclusion, Bounded Waiting.**
   - **Appeared in:** W22 (Q3a, 03 marks)
8. **Explain how semaphores can be used to deal with n-process critical section problem.**
   - **Appeared in:** S22 (Q2c, 07 marks)
9. **Explain wait and signal operations in semaphores.**
   - **Appeared in:** S23 (Q2c, 07 marks)

Unit 4: Inter-Process Communication (IPC) – Detailed Question List

Repeated Questions:

1. **Explain Classical IPC Problems:**
    - **Producer-Consumer / Bounded Buffer Problem**
        - **Appeared in:** S25 (Q2c, 07 marks), W24 (Q3c, 07 marks), W23 (Q3c, 07 marks)
    - **Readers-Writers Problem**
        - **Appeared in:** S25 (Q2c, 07 marks), S23 (Q3c, 07 marks), W22 (Q3c, 07 marks)
    - **Dining Philosophers Problem**
        - **Appeared in:** S23 (Q3c, 07 marks), W24 (Q3c, 07 marks), W25 (Q2c, 07 marks)
2. **Explain Semaphores and Monitors in solving IPC problems.**
    - **Appeared in:** Multiple papers across units

Other Important Questions:

3. **Explain Shared Memory vs Message Passing.**
    - **Appeared in:** S23 (Q3a, 03 marks)
4. **Explain the advantages of Inter-Process Communication.**
    - **Appeared in:** S23 (Q3a, 03 marks)
5. **Explain Race Condition, Critical Section, Mutual Exclusion in IPC context.**
    - **Appeared in:** S22 (Q3b, 04 marks)
6. **Explain Strict Alternation and Peterson's Solution.**
    - **Appeared in:** W24 (Q2c, 07 marks)
7. **Explain Event Counters and Message Passing.**
    - (Covered in theory)
8. **Explain Classical IPC Problems with semaphore/monitor solutions.**
    - **Appeared in:** S25 (Q2c, 07 marks), W23 (Q3c, 07 marks)

Unit 5: Deadlock – Detailed Question List

Repeated Questions:

1. **Explain Deadlock Conditions (Necessary Conditions).**
   - **Appeared in:** S23 (Q3b, 04 marks), S22 (Q3b, 04 marks), W24 (Q3a, 03 marks), W25 (Q4b, 04 marks)
2. **Explain Deadlock Avoidance using Banker's Algorithm.**
   - **Appeared in:** S25 (Q3c, 07 marks), S23 (Q4c, 07 marks), W23 (Q4c, 07 marks), W24 (Q5c, 07 marks), W25 (Q4c, 07 marks)
3. **Explain Deadlock Prevention, Avoidance, Detection, and Recovery.**
   - **Appeared in:** S22 (Q3c, 07 marks), W22 (Q3b, 04 marks)

Other Important Questions:

4. **Explain Resource Allocation Graph.**
   - **Appeared in:** W25 (Q4a, 03 marks), W22 (Q3a, 03 marks)
5. **Explain Deadlock Detection Algorithm.**
   - **Appeared in:** W23 (Q4c, 07 marks)
6. **Difference between Deadlock and Starvation.**
   - **Appeared in:** S25 (Q3a, 03 marks)
7. **Explain Deadlock Prevention in detail.**
   - **Appeared in:** W22 (Q3b, 04 marks)
8. **Explain how deadlock avoidance differs from deadlock prevention.**
   - **Appeared in:** S22 (Q3c, 07 marks)
9. **Explain methods for handling deadlocks.**
   - **Appeared in:** S23 (Q3b, 04 marks)
10. **Explain the two solutions of recovery from deadlock.**
    - **Appeared in:** S22 (Q3c, 07 marks)

Unit 6: Memory Management – Detailed Question List

Repeated Questions:

1. **Explain Internal vs External Fragmentation.**
   - **Appeared in:** S25 (Q4a, 03 marks), S23 (Q4b, 04 marks), W24 (Q3b, 04 marks), W25 (Q4c, 07 marks)
2. **Explain Paging, Segmentation, and Virtual Memory.**
   - **Appeared in:** S22 (Q4c, 07 marks), W24 (Q4b, 04 marks), W25 (Q4b, 04 marks)
3. **Explain Page Replacement Algorithms (FIFO, LRU, Optimal).**
   - **Appeared in:** S25 (Q4c, 07 marks), W24 (Q5c, 07 marks), W23 (Q5c, 07 marks)

Other Important Questions:

4. **Explain Memory Allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit).**
   - **Appeared in:** S23 (Q4a, 03 marks), W22 (Q4b, 04 marks), W24 (Q4c, 07 marks)
5. **Explain Address Binding, Logical vs Physical Addresses.**
   - **Appeared in:** S23 (Q4a, 03 marks), W24 (Q4a, 03 marks)
6. **Explain TLB (Translation Lookaside Buffer) and Paging Hardware.**
   - **Appeared in:** W24 (Q4b, 04 marks), W22 (Q4c, 07 marks)
7. **Explain Page Fault and its Handling.**
   - **Appeared in:** S23 (Q4b, 04 marks), W22 (Q4c, 07 marks), W25 (Q4a, 03 marks)
8. **Explain Thrashing.**
   - **Appeared in:** W23 (Q5a, 03 marks)
9. **Explain Swapping.**
   - **Appeared in:** W25 (Q5b, 04 marks)
10. **Explain Virtual Memory concepts and address translation.**
    - **Appeared in:** W22 (Q4c, 07 marks), W24 (Q4b, 04 marks)
11. **Explain Fixed vs Variable Partitioning.**
    - **Appeared in:** W25 (Q5b, 04 marks)
12. **Explain Relocation problem for multiprogramming with fixed partitions.**
    - **Appeared in:** S22 (Q4b, 04 marks)
13. **Numerical on Memory Allocation (First Fit, Best Fit, Worst Fit, Next Fit).**
    - **Appeared in:** W24 (Q4c, 07 marks)

Unit 7: I/O Management & Disk Scheduling – Detailed Question List

Repeated Questions:

1. **Explain Disk Arm Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN).**
   - **Appeared in:** S25 (Q4c, 07 marks), W23 (Q5b, 04 marks), W24 (Q5b, 04 marks), W25 (Q5c, 07 marks)
2. **Explain RAID Levels and their importance.**
   - **Appeared in:** S22 (Q4a, 03 marks), S25 (Q5c, 07 marks), W22 (Q5c, 07 marks), W25 (Q5c, 07 marks)
3. **Explain I/O Buffering and DMA.**
   - **Appeared in:** W24 (Q5a, 03 marks), W23 (Q4a, 03 marks), S25 (Q3c, 07 marks), W22 (Q5c, 07 marks)

Other Important Questions:

4. **Explain Goals of I/O Software.**
   - **Appeared in:** W25 (Q5a, 03 marks), W22 (Q5a, 03 marks)
5. **Numerical on Disk Scheduling (Total Head Movement, Seek Time).**
   - **Appeared in:** W23 (Q5b, 04 marks)
6. **Explain Block vs Character Devices.**
   - **Appeared in:** W22 (Q5a, 03 marks)
7. **Explain Disk Cache.**
   - (Covered in theory)
8. **Explain Organization of I/O functions and OS design issues.**
   - (Covered in theory)
9. **Explain the difference between logical I/O and device I/O.**
   - **Appeared in:** S22 (Q4a, 03 marks)
10. **Compare RAID level 3 with RAID level 4.**
    - **Appeared in:** W23 (Q4a, 03 marks)

Unit 8: Security & Protection – Detailed Question List

Repeated Questions:

1. **Explain Access Control List (ACL) and Protection Domains.**
   - **Appeared in:** S22 (Q5a, 03 marks), W23 (Q4b, 04 marks)
2. **Explain Security vs Protection.**
   - **Appeared in:** S25 (Q5a, 03 marks)
3. **Explain System Threats and Program Threats.**
   - **Appeared in:** S23 (Q5b, 04 marks)

Other Important Questions:

4. **Explain Design Principles of Security.**
   - **Appeared in:** W23 (Q4b, 04 marks)
5. **Explain Capability Lists vs Access Lists.**
   - **Appeared in:** S23 (Q5a, 03 marks)
6. **Explain User Authentication and Protection Mechanisms.**
   - (Covered in theory)
7. **Explain Security Environment.**
   - (Covered in theory)
8. **Explain Domain of Protection.**
   - **Appeared in:** S23 (Q5a, 03 marks), S22 (Q5a, 03 marks)
9. **Explain Protection Domain and Access Control List.**
   - **Appeared in:** S22 (Q5a, 03 marks)

Unit 9: Unix/Linux Operating System – Detailed Question List

Repeated Questions:

1. **Explain Unix/Linux Commands (cat, rmdir, sort, chmod, grep, mkdir, etc.).**
   - **Appeared in:** S25 (Q4b, 04 marks), W22 (Q5b, 04 marks)
2. **Explain Unix/Linux File and Directory Management.**
   - **Appeared in:** S25 (Q5c, 07 marks)
3. **Explain Inode and its usage.**
   - **Appeared in:** W24 (Q5a, 03 marks)

Other Important Questions:

4. **Explain Unix Kernel.**
   - **Appeared in:** S22 (Q5b, 04 marks)
5. **Compare Windows and Linux File Systems.**
   - **Appeared in:** S22 (Q5b, 04 marks)
6. **Explain Synchronization in Linux.**
   - **Appeared in:** S23 (Q5c, 07 marks)
7. **Explain Role & Function of Kernel, System Calls, Shell Programming.**
   - (Covered in theory)
8. **Explain Elementary Linux commands and Shell Programming.**
   - **Appeared in:** S25 (Q4b, 04 marks), W22 (Q5b, 04 marks)
9. **Explain Directory Structure and System Administration (Case Study: Linux, Windows).**
   - (Covered in theory)
10. **Write a shell script to find factorial of a number.**
    - **Appeared in:** S25 (Q4a, 03 marks), W23 (Q1b, 04 marks)
11. **Explain the advantages of Linux/Unix over Windows.**
    - **Appeared in:** W24 (Q5b, 04 marks)
12. **Explain System Calls in Unix/Linux.**
    - **Appeared in:** W24 (Q2b, 04 marks)

Unit 10: Virtualization Concepts – Detailed Question List

Repeated Questions:

1. **Explain Virtualization and its Benefits.**
   - **Appeared in:** S23 (Q5c, 07 marks), W22 (Q5b, 04 marks), W24 (Q4a, 03 marks)
2. **Explain Pure/True Virtualization.**
   - **Appeared in:** W23 (Q1a, 03 marks)

Other Important Questions:

3. **Explain Virtual Machine Architecture.**
   - **Appeared in:** W24 (Q1b, 04 marks)
4. **Explain supporting multiple OS simultaneously on a single hardware platform.**
   - (Covered in theory)
5. **Explain running one OS on top of another.**
   - (Covered in theory)
6. **Explain True or Pure Virtualization.**
   - **Appeared in:** W23 (Q1a, 03 marks)
7. **Explain the concept of Virtual Machines.**
   - **Appeared in:** S25 (Q5b, 04 marks)

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