# OS Exam Preparation Breakdown

## 1. Multiprocessor & Clustered Systems

Multiprocessor System:

- Multiple CPUs sharing memory.

- Types: Symmetric (SMP), Asymmetric (AMP)

- Advantages: Better throughput, fault tolerance, scalability

Clustered System:

- Multiple systems work together, often sharing storage.

- Types: Asymmetric (standby), Symmetric (all active)

- Purpose: High availability, load balancing, HPC

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## 2. Multiprogramming & Multitasking

Multiprogramming:

- Keeps CPU busy by switching between multiple jobs.

- Needs job scheduling and memory management.

Multitasking (Time-Sharing):

- CPU switches tasks frequently, allowing interactive use.

- Uses timer interrupts and CPU scheduling.

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## 3. I/O Handling Methods

Polling:

- CPU checks I/O device status repeatedly.

- Pros: Simple; Cons: CPU time wasted

Interrupt-Driven I/O:

- Device sends interrupt to CPU when ready.

- Pros: Efficient CPU usage; Cons: Needs extra handling logic

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## 4. Memory Device Hierarchy

From fastest to slowest:

1. Registers - Fastest, expensive, small

2. Cache - Very fast, small

3. RAM - Fast, moderate cost

4. SSD - Medium speed, large

5. HDD - Slower, cheaper

6. Tape/Optical - Slowest, archival use

Higher levels = faster, costlier, smaller.

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## 5. Program vs Process

Program:

- Static code stored on disk

Process:

- Active program execution with code, stack, heap, and CPU state

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## 6. Process State & PCB

Process States:

- New   Ready   Running   Waiting   Terminated

Process Control Block (PCB) Includes:

- Process state, Registers, Program counter, Memory info, I/O info

## 7. Virtual Memory

- Provides illusion of large memory using paging/segmentation.

- Benefits: Larger program support, efficient memory use, isolation.

- Swapping used to manage limited physical memory.

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## 8. Concurrency (Basic Idea)

Concurrency:

- Multiple processes active simultaneously.

Key Concepts:

- Mutual Exclusion - prevents simultaneous access to critical section

- Condition Variables - wait/signal to coordinate

- Semaphores/Locks - control access to shared resources

Example: Producer-Consumer Problem with shared buffer and synchronization