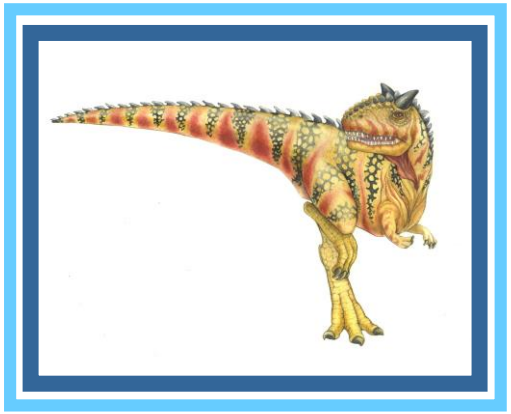
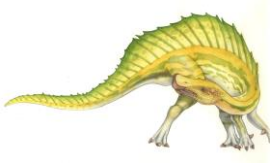
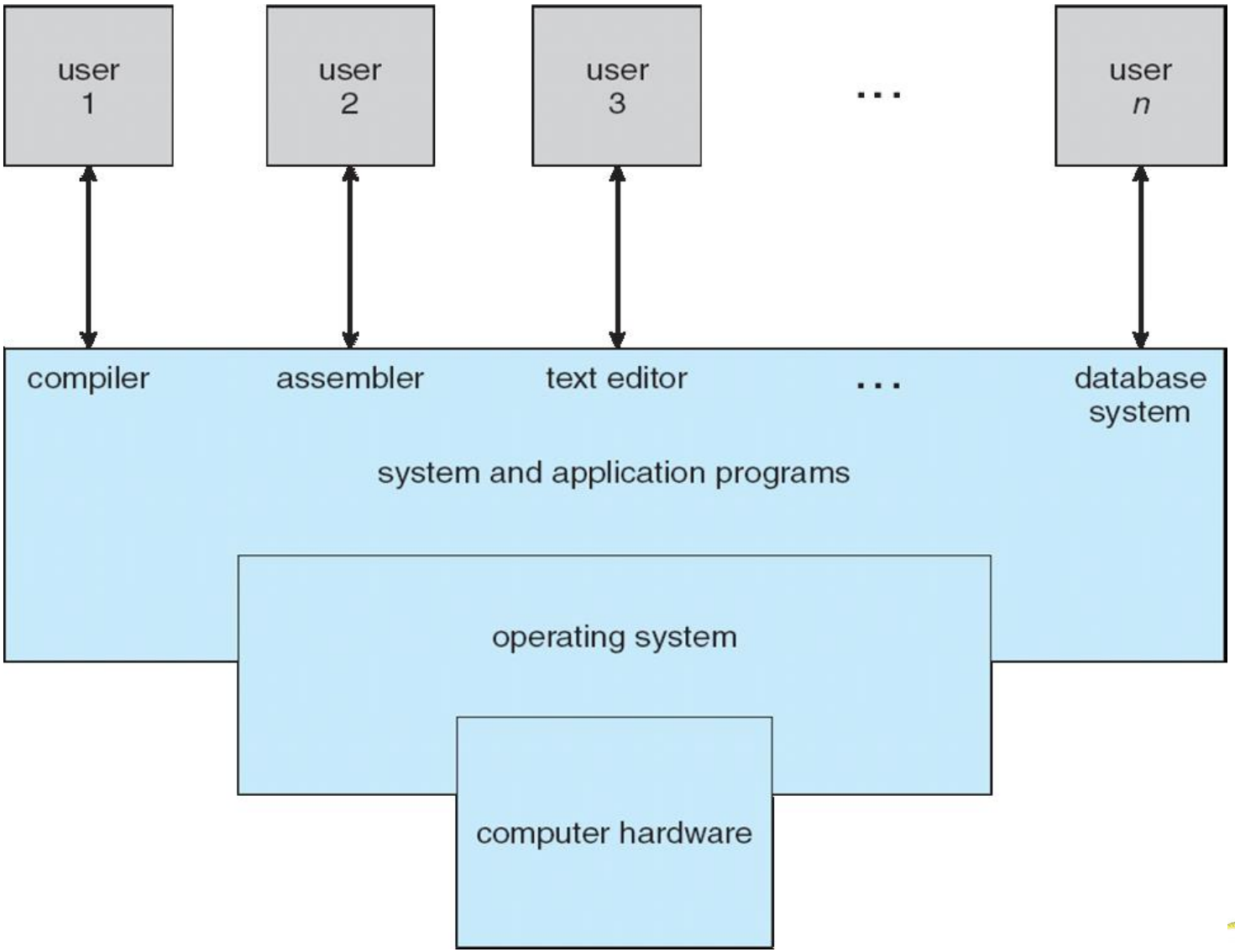
Operating System Introduction



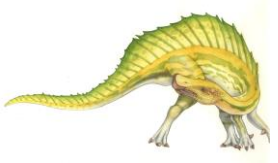


Four Components of a Computer System



Computer System Structure

- Computer system can be divided into four components:
  - Hardware
    - CPU, memory, I/O devices
  - Operating system
    - Controls and coordinates use of hardware among various applications and users
  - Application programs
    - Word processors, compilers, web browsers, database systems, video games
  - Users
    - People, machines, other computers



What is an Operating System?

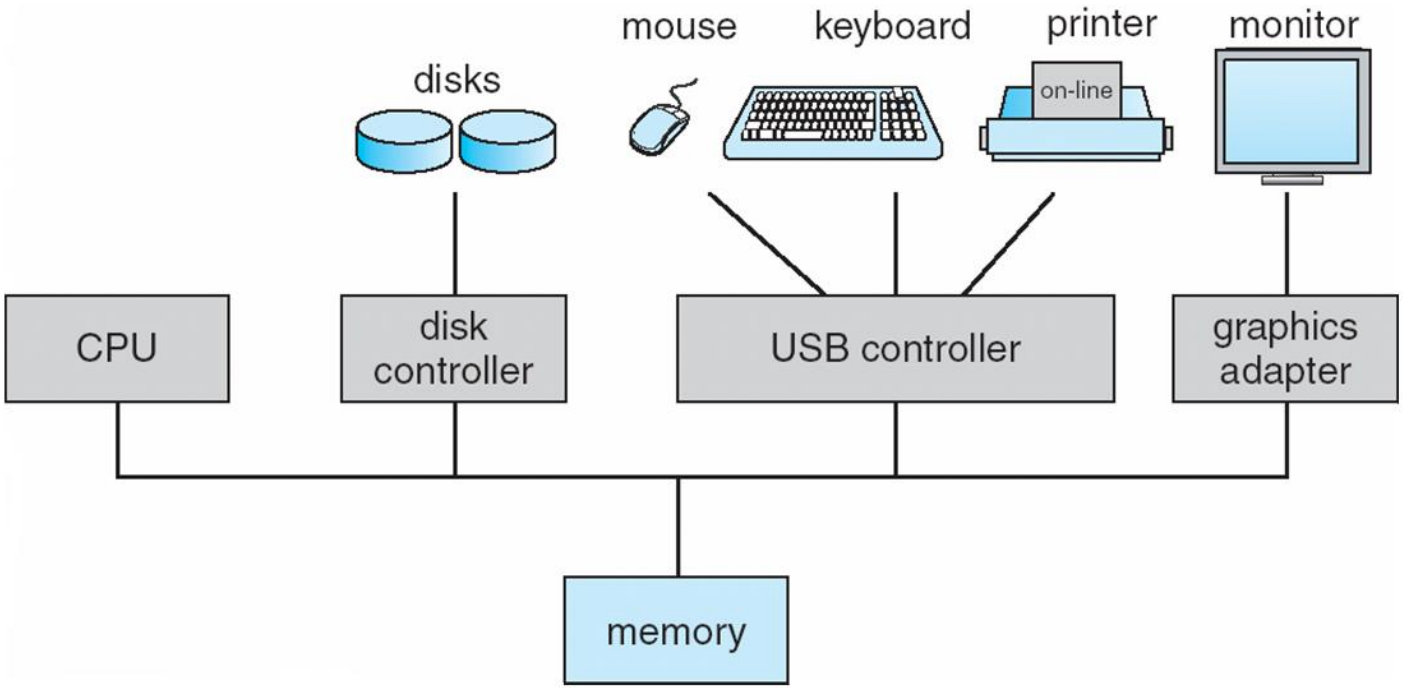
- A program that acts as an intermediary between a user of a computer and the computer hardware.
- “The one program running at all times on the computer” is the **kernel**. Everything else is either a system program (ships with the operating system) or an application program.

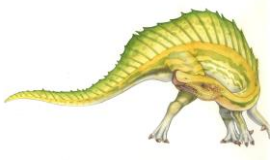
Operating System Functions

- OS is a **resource allocator**
  - Manages all resources
  - Decides between conflicting requests for efficient and fair resource use
- OS is a **control program**
  - Controls execution of programs to prevent errors and improper use of the computer
  - Error in one program should not affect other programs

Computer System Organization

- Computer-system operation
  - One or more CPUs, device controllers connect through common bus providing access to shared memory





Computer-System Operation

- I/O devices and the CPU can execute concurrently
- Each device controller is in charge of a particular device type
- Each device controller has a local buffer
- CPU moves data from/to main memory to/from local buffers
- I/O is from the device to local buffer of controller
- Device controller informs CPU that it has finished its operation by causing an interrupt

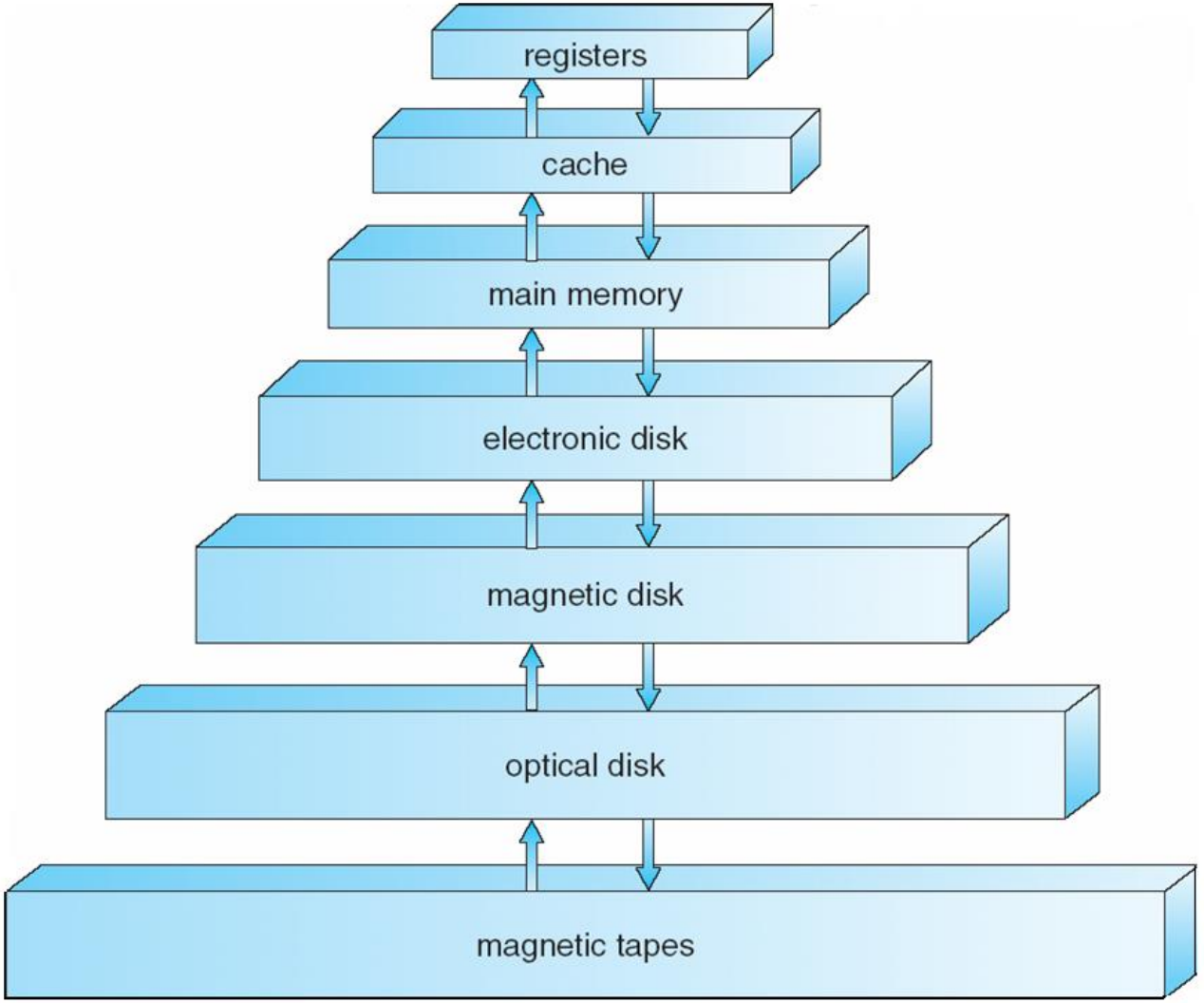
Computer Startup

- **bootstrap program** is loaded at power-up or reboot
  - Typically stored in ROM or EPROM, generally known as **firmware**
  - Initializes all aspects of system
  - Loads operating system kernel and starts execution

Storage Hierarchy

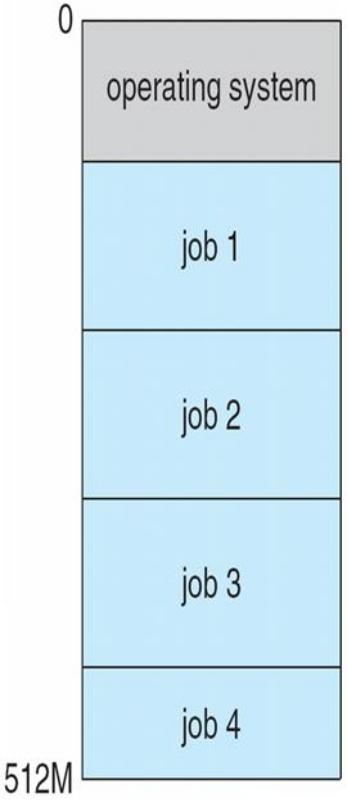
- Storage systems organized in hierarchy
  - Speed
  - Cost
  - Volatility
- **Caching** – copying information into faster storage system; main memory can be viewed as a *cache* for secondary storage

Storage-Device Hierarchy

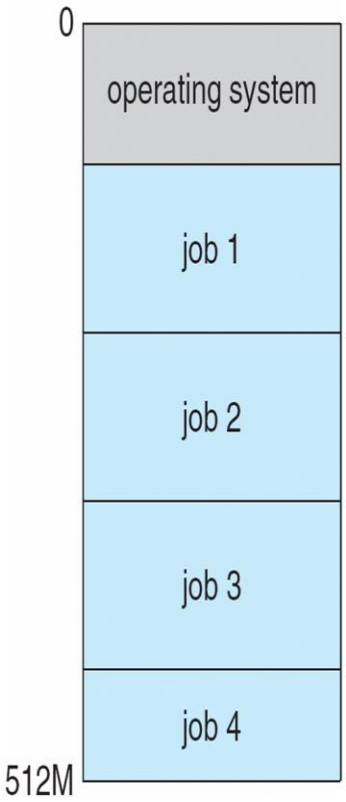


Operating System Structure

- **Multiprogramming** needed for efficiency
  - Single user cannot keep CPU and I/O devices busy at all times
  - Multiprogramming organizes jobs (code and data) so CPU always has one to execute
  - A subset of total jobs in system is kept in memory
  - One job selected and run via **job scheduling**
  - When it has to wait (for I/O for example), OS switches to another job



Memory Layout for Multiprogrammed System



Timesharing (multitasking) : CPU switches jobs so frequently that users can interact with each job while it is running, creating **interactive** computing

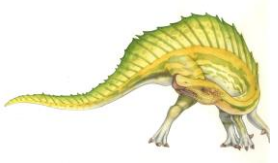
Response time should be < 1 second

Each user has at least one program executing in memory ⇨**process**

If several jobs ready to run at the same time ⇨ **CPU scheduling**

If processes don't fit in memory, **swapping** moves them in and out to run

Virtual memory allows execution of processes not completely in memory



Syllabus :

CS 231	Operating Systems
3-0-0-6	

Process Management: process, thread, scheduling; Concurrency: mutual exclusion, synchronization, semaphores, deadlocks;

Memory Management: allocation, protection, hardware support, paging, segmentation; Virtual Memory: demand paging, allocation, replacement, swapping, segmentation, TLBs;

File Management: naming, file operations and their implementation;

File Systems: allocation, free space management, directory management, mounting;

I/O Management: device drivers, disk scheduling, Basics of Security

Books

Text :

1. Silberschatz, A. and Galvin, P. B. Operating System Concepts. 8/e. Wiley, 2008.

References :

1. Stalling, W. Operating Systems: Internals and Design Principles. 6/e. Pearson, 2008.

2. Tanenbaum, A. S. Modern Operating System. 3/e. Pearson, 2007.

3. Dhamdhere, D. M. Operating SystemsA Concept Based Approach, McGrawHill, 2008

End sem – 50 % +/- 5

Mid sem – 30 % +/- 5

Grading

2 class tests – 20 % +/- 5

End of Chapter 1