CSE3241: Operating System and System Programming

Class-20

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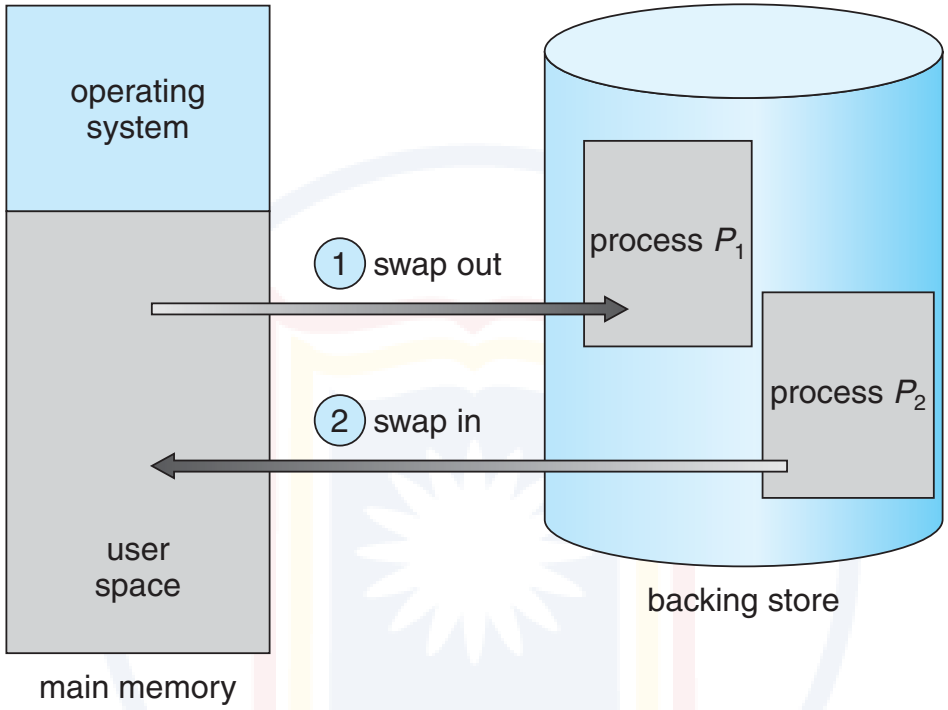
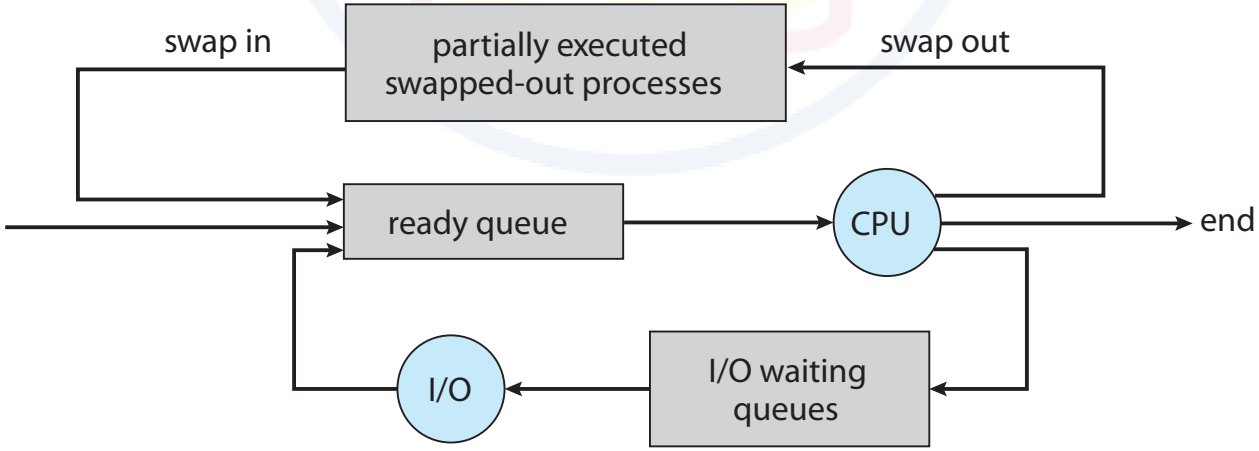
Scheduler

- **Scheduler** is the part of OS which manages processes in different queues so that processes do not stay in any quere for long time.

- Types of Schedulers:
  1. Long-term Scheduler:
     - mass storage device $\longrightarrow$ memory.
     - batch system uses it.
     - also known as job scheduler.
     - runs only when a process leaves the system.
  2. Mid-term Scheduler:
     - ready queue $\longleftrightarrow$ virtual memory.
     - some modern, time-sharing OS like Linux uses it.
  3. Short-term Scheduler:
     - ready queue $\longrightarrow$ CPU.
     - all multi-programming OS uses it.
     - also known as CPU scheduler.
     - runs very frequently.

Mid-Term Scheduler in Swapping





Memory Allocation

- **Degree of Multiprogramming**: is the number of processes in memory.

- In a multiprogramming system, OS has to allocate memory efficiently so that both OS and User processes can stay in memory happily.

- Types of Memory Allocation:

  1. **Contiguous Allocation**: Each process is contained in a single **contiguous** section of memory.
     - Fixed-Sized Allocation
     - Dynamic Allocation

  2. **Non-Contiguous Allocation**: A process resides in different parts of the memory.
     - Paging

Fixed-Sized Allocation

- Memory is divided into several fixed-sized partitions.
- When a partition is free:
  - a process is selected from the input queue, and
  - loaded into the free partition.
- Simple but:
  - waste lot of memory.
  - cannot provide memory for larger process.
- It is primarily used in the batch system.
- IBM OS/360 used it.
- It is no longer in use.

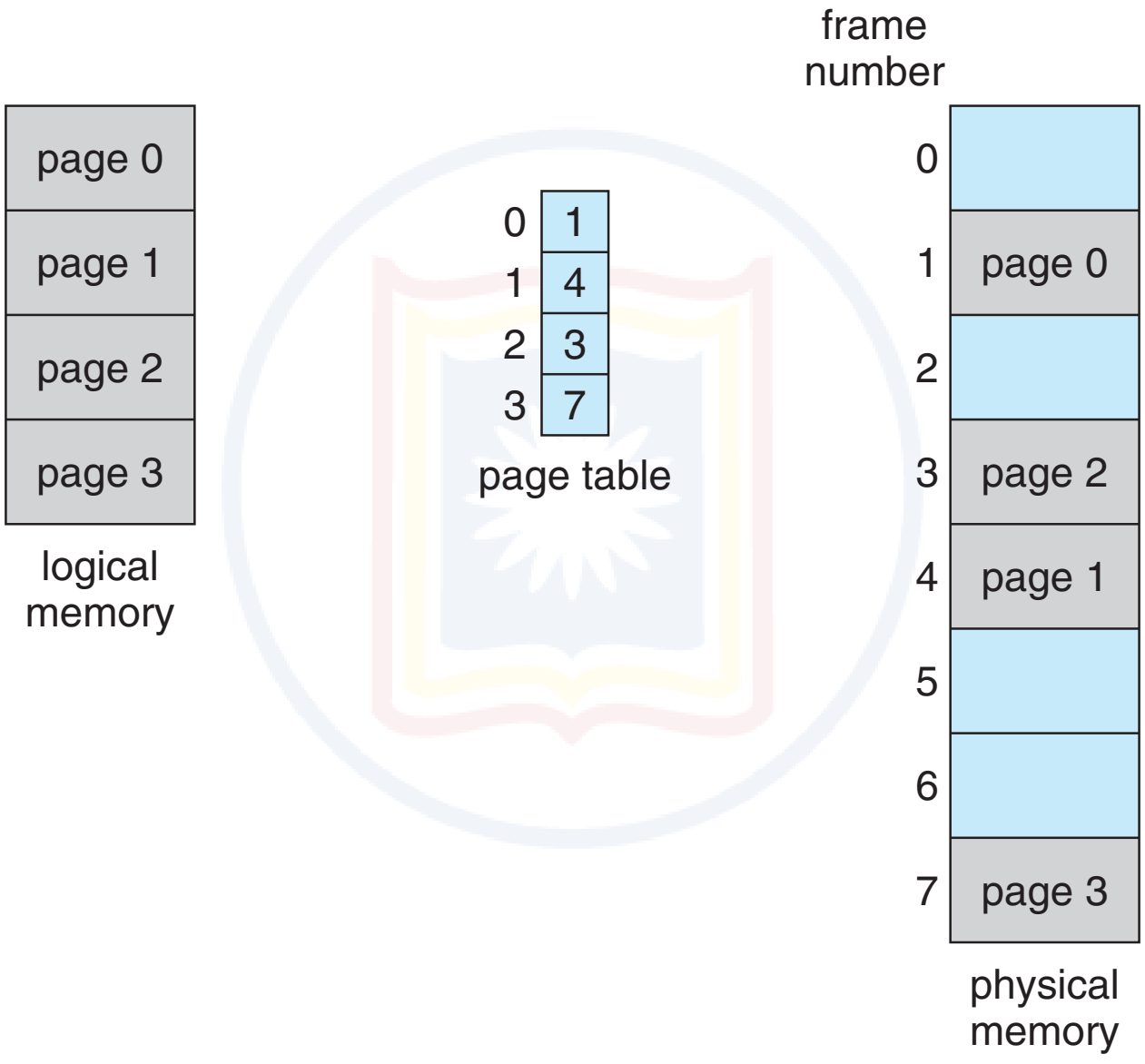
Dynamic Allocation

- Initially all memory in the user space is considered as big **hole**.
- When a process arrives and needs a memory, OS search for a hole big enough for that process.
- Ways of Free Memory Allocation:
  1. First Fit:
     - allocate the first hole that is big enough.
     - searching is stopped as soon as the appropriate free hole is found.
  2. Best Fit:
     - allocate the smallest hole that is big enough.
     - search the entire list unless it is sorted.
  3. Worst Fit:
     - allocate the largest hole.
     - search the entire list unless it is sorted.

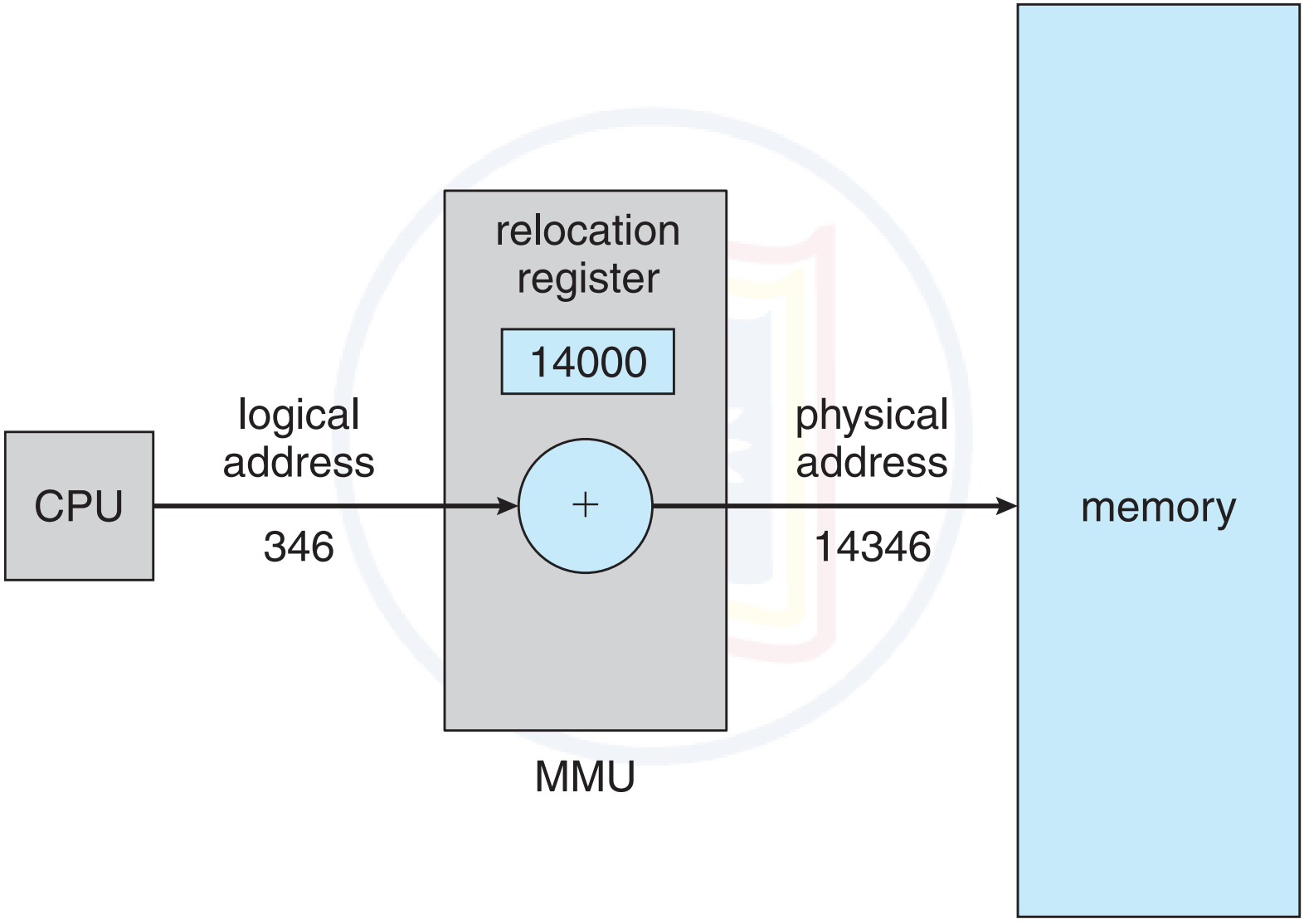
Paging

- It permits the physical space of a process to be **non-contiguous**.
- It avoids of keeping the process await in the input queue.
  - previous memory management schemes suffered.
- At the beginning paging was handled by special hardware.
- Then both hardware and OS were designed to hande paging.
- Most modern OS uses it.

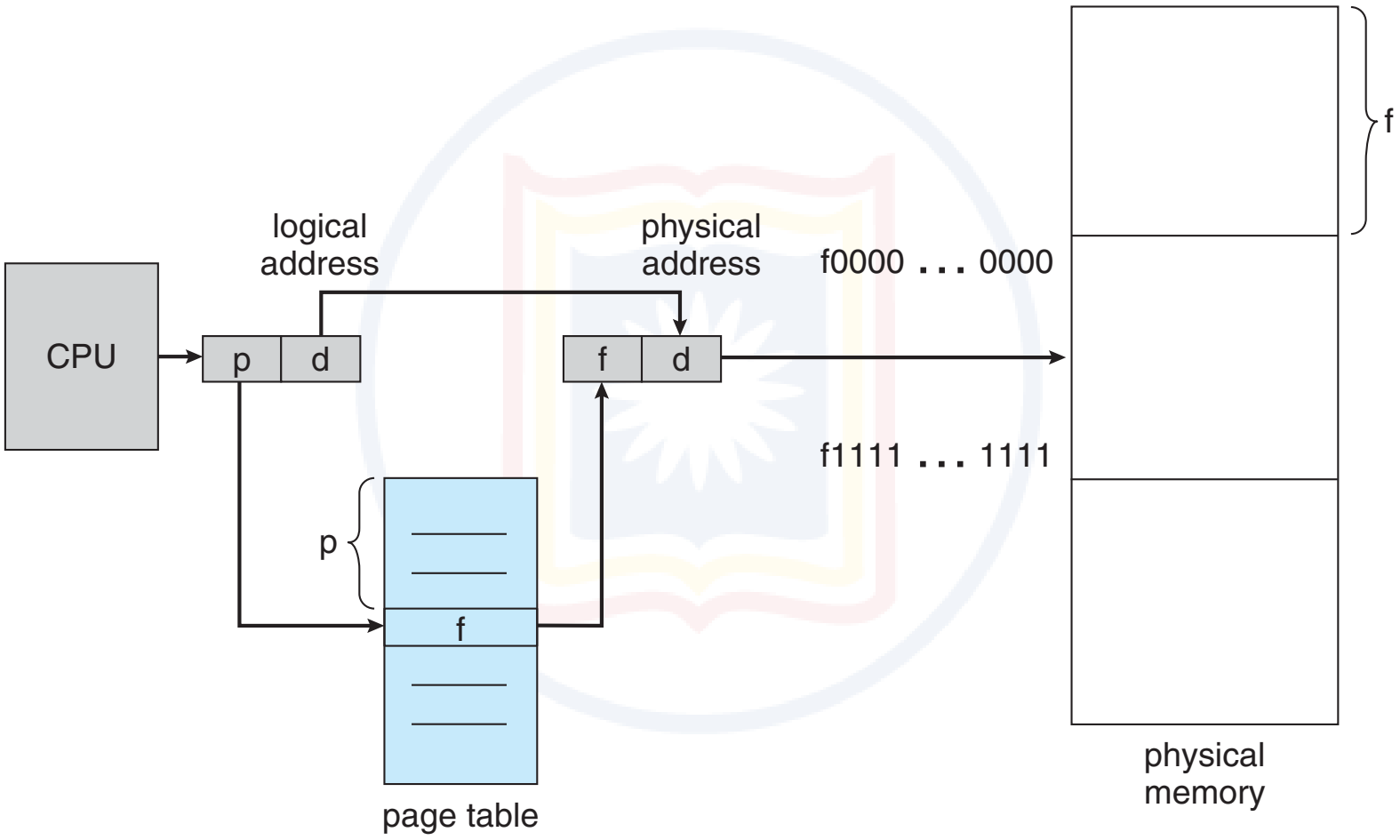
Paging Model[1]



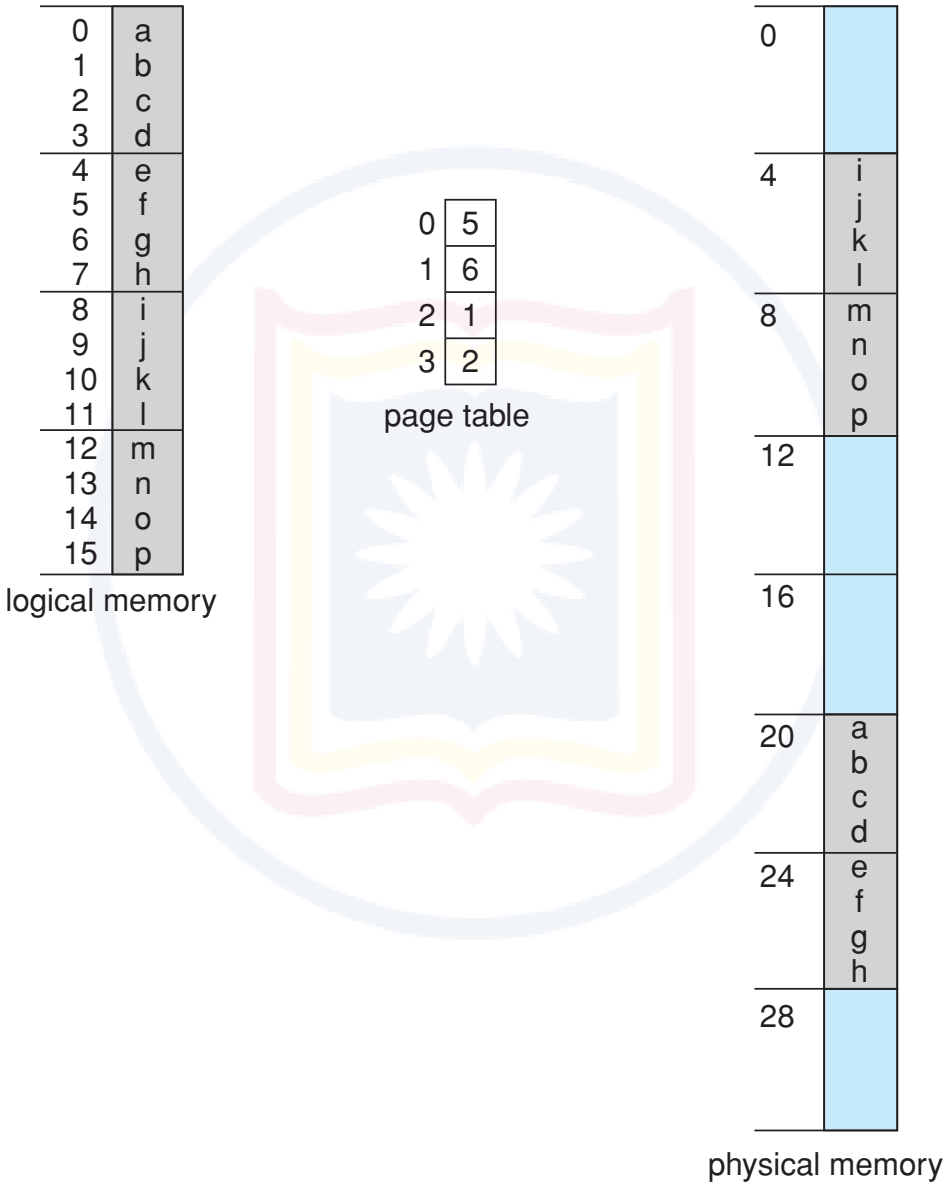
Contiguous Allocation[1]



Paging Hardware[1]



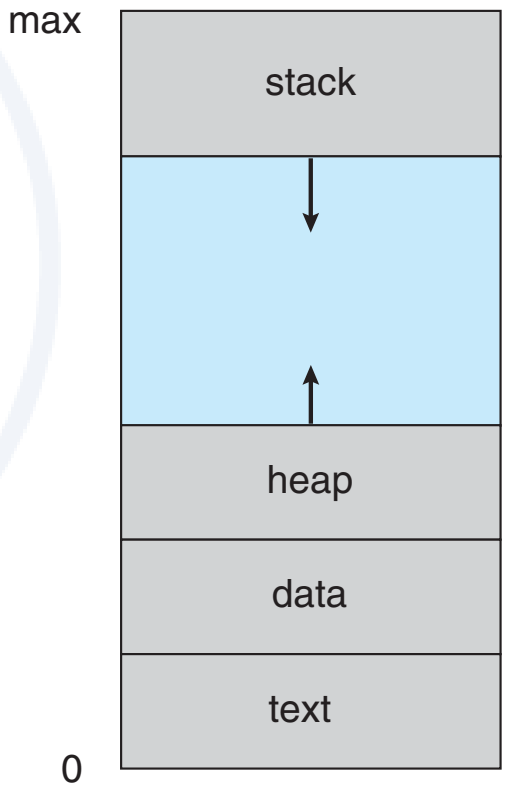
Paging Example for 32 byte memory[1]



Memory Layout of a Program

- Address space of a process contains:
  - **Stack**: temporary data such as function parameters, return addresses, local variables.
  - **Heap**: dynamically allocated memory locations.
  - **Data Section**: global variables.
  - **Text Section**: executable program.

Process in memory [1]



References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