

# **FACULTY OF ENGINEERING AND TECHNOLOGY UNIVERSITY OF LUCKNOW LUCKNOW**



## **Operating System AI-602**

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# PAGE REPLACEMENT ALGORITHMS

## (Part-1)

# Page Replacement Algorithms

- FIFO Page replacement Algorithm
- Optimal Page Replacement Algorithm
- Least Recently Used (LRU) Algorithm

# FIFO PAGE REPLACEMENT

# FIFO Page Replacement

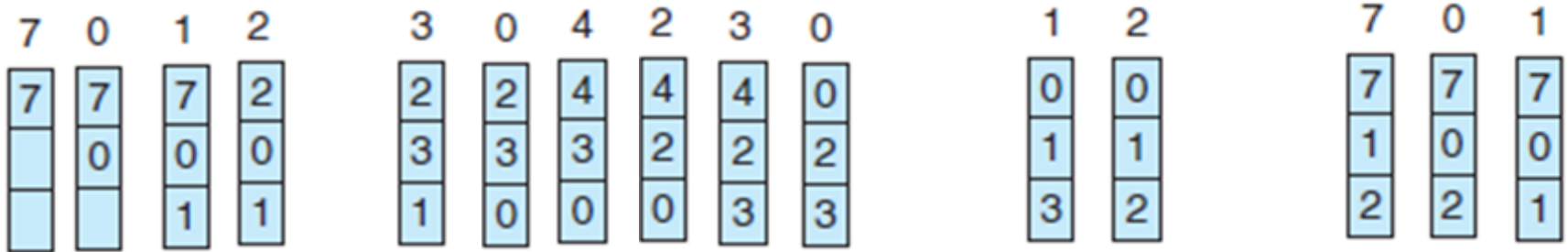
- When a page must be replaced, the *oldest page* is chosen.
- We can create a *FIFO queue* to hold all pages in memory.
- We replace the page at the *head* of the queue.
- When a page is brought into memory, we insert it at the *tail* of the queue.

# Example 1

- Let three frames are initially empty.

reference string

7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1



page frames →

# Question

- Let the *reference string*: 1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5
- Find the number of page faults for
  1. One frame
  2. Two frame
  3. Three frame
  4. Four frame
- Answer:
  1. One frame (12)
  2. Two frame (12)
  3. Three frame (9)
  4. Four frame (10)

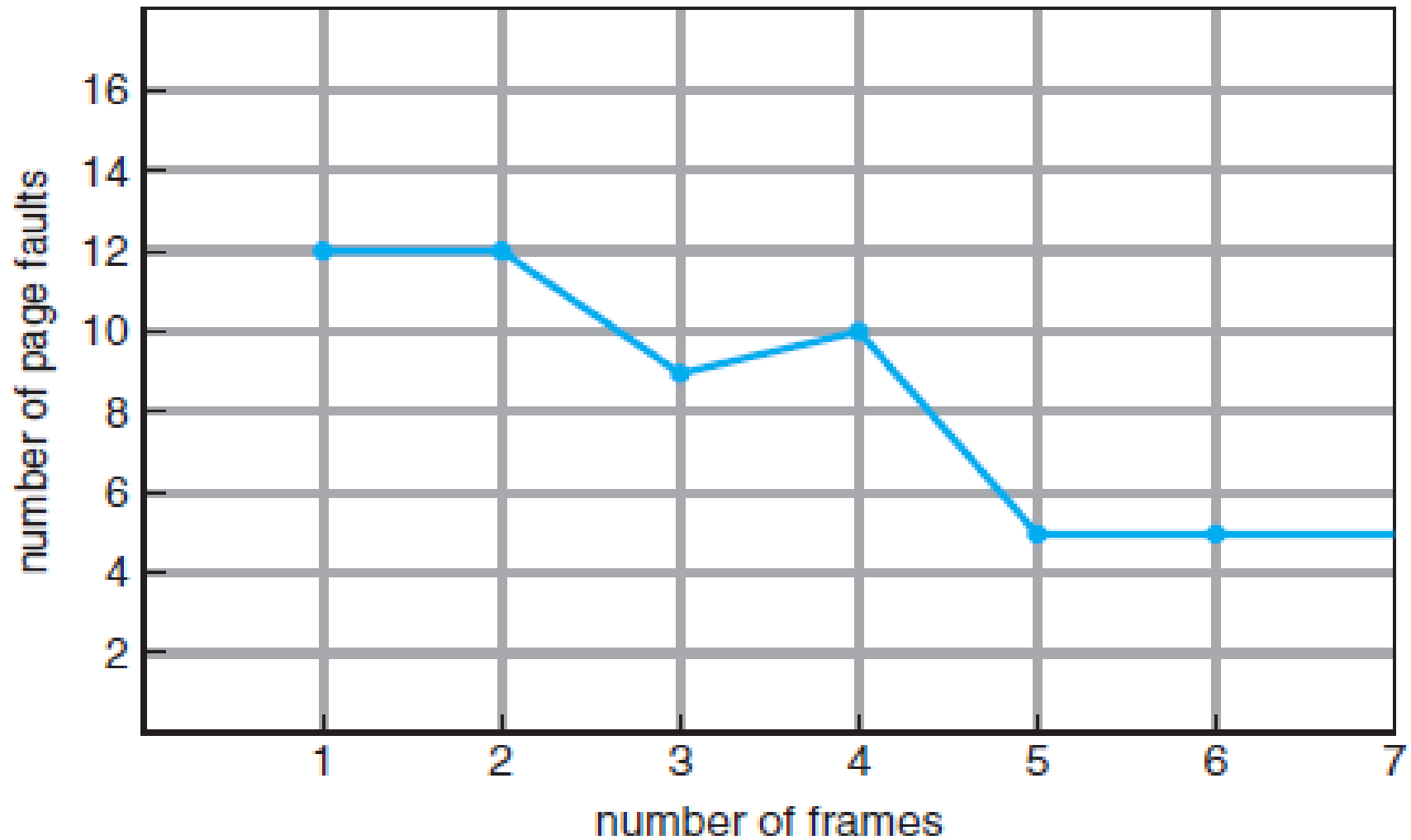
# Inference

- Notice that the number of faults for four frames (ten) is *greater* than the number of faults for three frames (nine)!
- This most unexpected result is known as *Belady's anomaly*.
- **Belady's anomaly:**
  - For some page-replacement algorithms, the *page-fault rate* may increase as the number of allocated frames increases.



# Inference

- Belady's anomaly



# References

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley.
2. William Stallings, “Operating Systems: Internals and Design Principles”, 6<sup>th</sup> Edition, Pearson Education.
3. D M Dhamdhere, “Operating Systems: A Concept based Approach”, 2<sup>nd</sup> Edition, TMH.

**Thank You.**

