Department of Computer Science and Engineering

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CS-501

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PAGE REPLACEMENT ALGORITHMS

Page Replacement Algorithms

- FIFO Page replacement Algorithm

- Optimal Page Replacement Algorithm

- Least Recently Used (LRU) Algorithm

FIFO PAGE REPLACEMENT
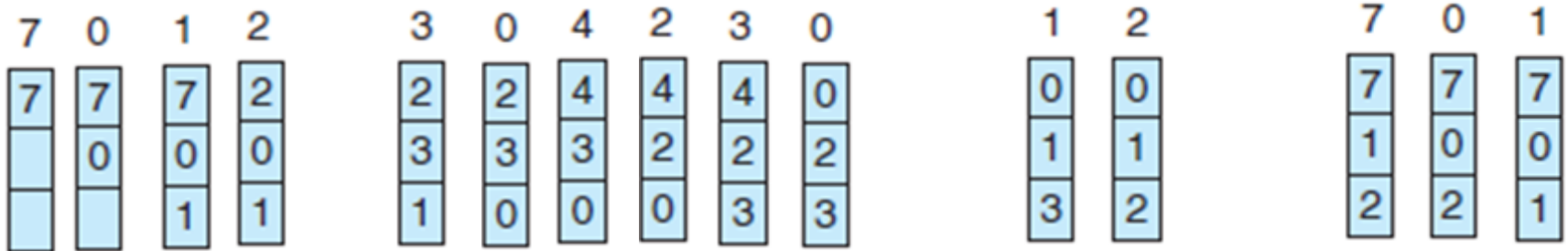
FIFO Page Replacement

- 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

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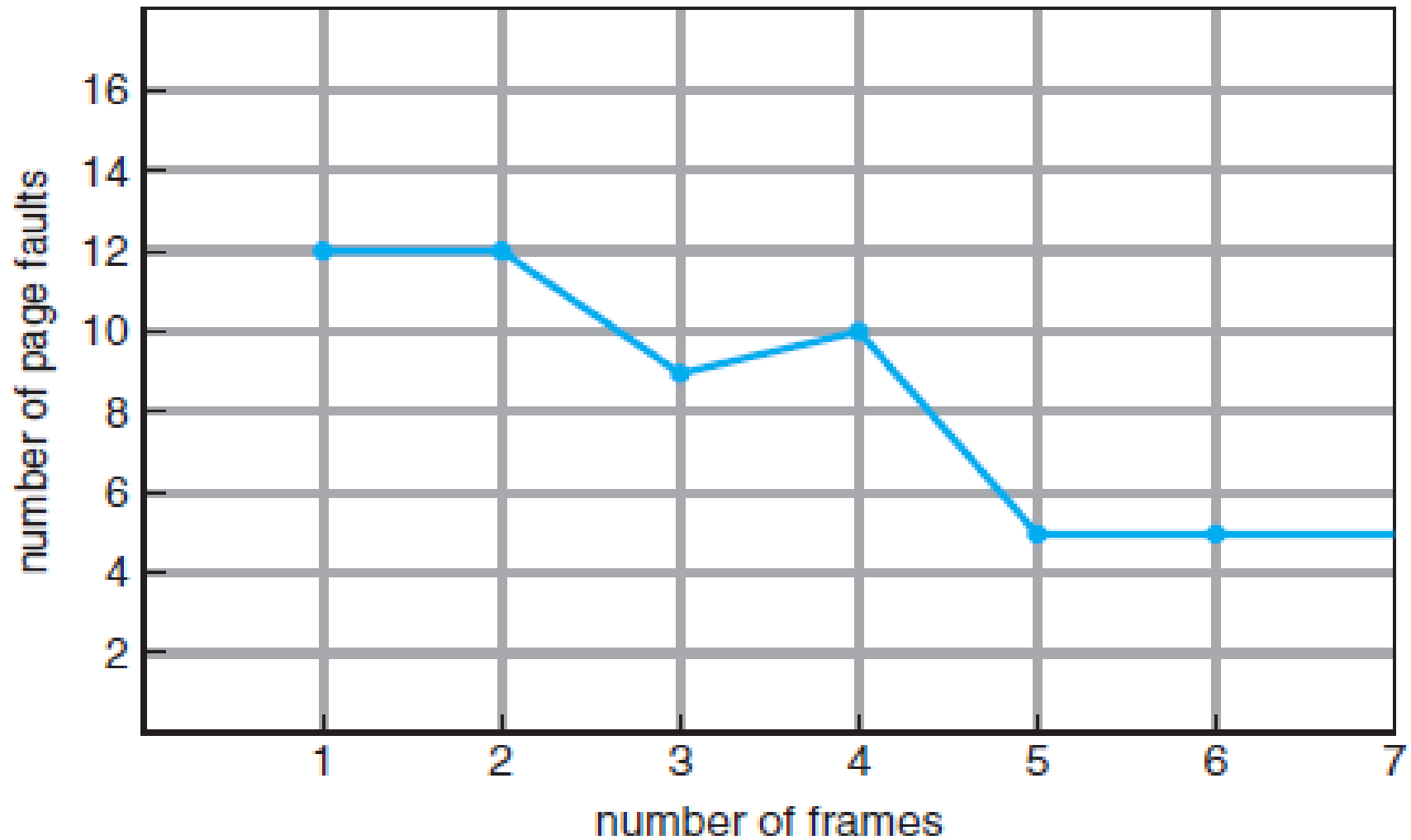
References

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley.

2. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education.

3. D M Dhamdhere, "Operating Systems: A Concept based Approach", 2nd Edition, TMH.

Thank You.