CO - 1

Session : 8

COURSE NAME : SYSTEM DESIGN AND INTRODUCTION TO CLOUD

COURSE CODE : 23AD2103A

TOPICS : PAGE REPLACEMENT ALGORITHMS

SESSION DESCRIPTION

- PAGE REPLACEMENT ALGORITHMS
- FIFO
- LRU
- OPTIMAL

PAGE FAULT

- A page fault will happen if a program tries to access a piece of memory that does not exist in physical memory (main memory).
- The fault specifies the operating system to trace all data into virtual memory management and then relocate it from secondary memory to its primary memory, such as a hard disk.
- The page fault primarily causes an exception, which is used to notify the operating system to retrieve the **"pages"** from virtual memory to continue operation.

PAGE HIT

- A page fault will happen if a program tries to access a piece of memory that does not exist in physical memory (main memory).

PAGE REPLACEMENT ALGORITHMS

- A **page replacement algorithm** tries to select which pages should be replaced so as to minimize the total number of page misses.

- First In First Out (FIFO)
- Least Recently Used (LRU)
- Optimal Page Replacement

PAGE REPLACEMENT ALGORITHM – FIRST IN FIRST OUT (FIFO)

FIFO is one of the simplest page replacement algorithms. A FIFO page replacement algorithm associates with each page the time when that page was brought into memory. At the point when a page must be replaced, the most experienced or oldest page is selected.

Consider the following reference string: 0, 2, 1, 6, 4, 0, 1, 0, 3, 1, 2, 1. Using FIFO page replacement algorithm –

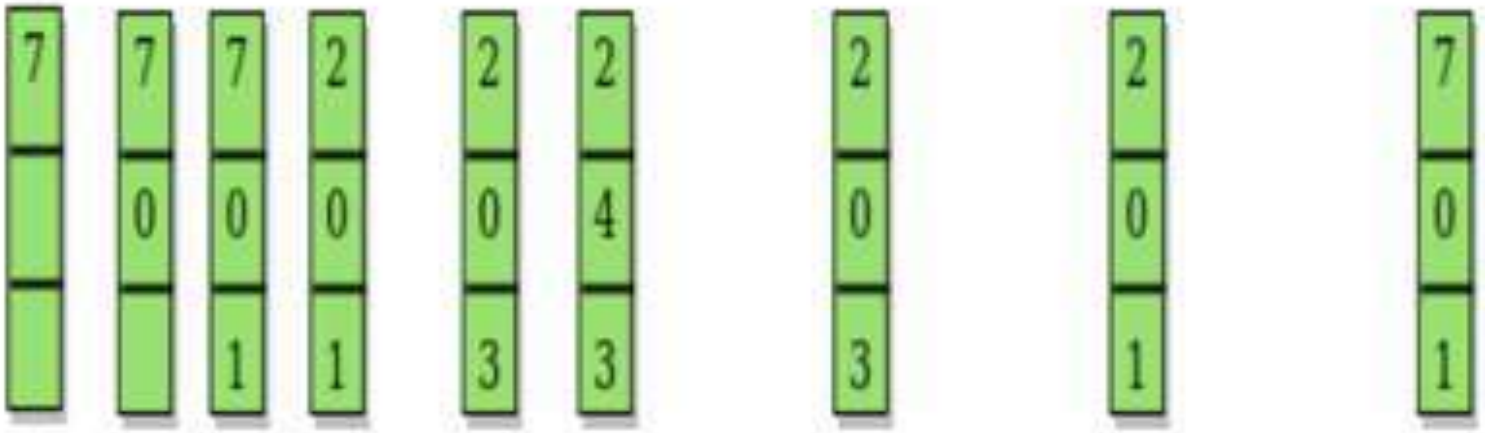
0	2	1	6	4	0	1	0	3	1	2	1
0	0	0	0	4	4			4	4	2	
	2	2	2	2	0		hit	0	0	0	
		1	1	1	1	hit		3	3	3	
			6	6	6			6	1	1	hit

So, total number of page faults = 9. Given memory capacity (as number of pages it can hold) and a string representing pages to be referred, write a function to find number of page faults.

PAGE REPLACEMENT ALGORITHM – OPTIMAL PAGE REPLACEMENT ALGORITHM

The Optimal Page Replacement algorithm has the lowest page fault rate of all algorithms. The criteria of this algorithm is " **Replace a page that will not be used for the longest period of time" (The Longest Time in Feature)**

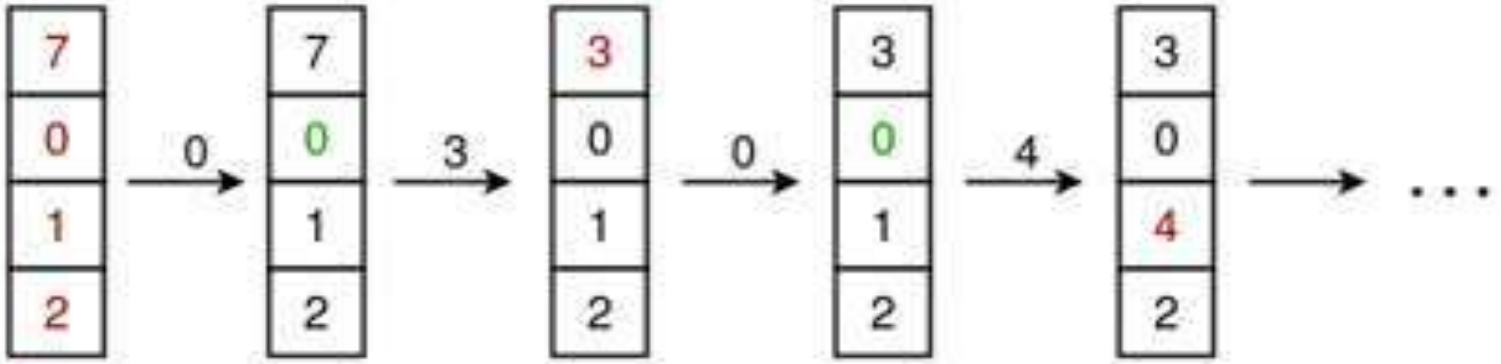
7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1



PAGE REPLACEMENT ALGORITHM – LEAST RECENTLY USED (LRU)

The Least Recently Used (LRU) page replacement policy replaces the page that has not been used for the longest period of time. It is one of the algorithms that were made to approximate if not better the efficiency of the optimal page replacement algorithm.

page reference string 7 0 1 2 0 3 0 4 2 3 0 3 2 and Frame set is 4



Total Page faults = 6

PAGE REPLACEMENT ALGORITHM – LEAST FREQUENTLY USED (LFU)

Frame	0	1	2	3	0	1	2	3	0	1	2	3	4	5	6	7
0	0*	0	0	0	0+	0	0	0	0+	0	0	3*	3	3	3	3
1		1*	1	1	1	1+	1	3*	3	1*	1	1	1	1	1	1
2			2	3*	3	3	2*	2	2	2	2+	2	4	5*	6*	7*
	✔	✔	✔	✔	✘	✘	✔	✔	✘	✔	✘	✔	✔	✔	✔	✔

Table: LFU

The Least Frequently used algorithm "Selects a page for replacement, if the page has not been used often in the past" or "Replace page that page has smallest count"

PAGE REPLACEMENT ALGORITHM – MOST FREQUENTLY USED (MFU)

Most Frequently Used

MFU Page Replacement Algorithm

3 Frames in memory

Pages to be inserted	1	2	3	4	1	2	5	1	2	3	4	5
Frame 1	1	1	1	4	4	4	5	5	5	5		
Frame 2		2	2	2	1	1	1	1	1	3		
Frame 3			3	3	3	2	2	2	2	2		

Page Fault Rate (p)
= Number of Page Faults/Total Number of Memory References
= 10 / 12 = 0.833

Page 5: 1
Page 1: 2
Page 2: 2

The Most Frequently used algorithm "Selects a page for replacement, if the page has been used often in the past" or "Replace page that page has highest count"

THANK YOU

(DEEMED TO BE UNIVERSITY)

Team – System Design & Introduction to Cloud