

Operating System

Digital Assignment 1

Name: Om Ashish Mishra

Registration Number: 16BCE0789

Slot: A1+TA1

1. Given page reference string: Compare the number of page faults for LRU, FIFO and Optimal page replacement algorithm

1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6

Ans:

FIFO

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
1	1	1	4		4	4	6	6	6		3	3	3		2	2		2	6
	2	2	2		1	1	1	2	2		2	7	7		7	1		1	1
		3	3		3	5	5	5	1		1	1	6		6	6		3	3
F	F	F	F	H	F	F	F	F	F	H	F	F	F	H	F	F	H	F	F

Number of faults = 16

Optimal page

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
1	1	1	1		1	1	1				3	3			3	3			3
	2	2	2		2	2	2				2	7			2	2			2
		3	4		3	5	6				6	6			6	1			6
F	F	F	F	H	F	F	F	H	H	H	F	F	H	H	F	F	H	H	F

Number of faults = 12

LRU

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
1	1	1	4		4	5	5	5	1		1	7	7		2	2			2
	2	2	2		2	2	6	6	6		3	3	3		3	3			3
		3	3		1	1	1	2	2		2	2	6		6	1			6
F	F	F	F	H	F	F	F	F	F	H	F	F	F	H	F	F	H	H	F

Number of faults = 15

2. If you have more page frames you will be having fewer page faults Right or wrong?
Justify your answer for the below reference string using FIFO page replacement algorithm. Consider total page frames initially as 3 and increase it to 4.

(a) 3 2 1 0 3 2 4 3 2 1 0 4

Ans:

Here F = faults and H = hits.

FIFO with 3 frames

3	2	1	0	3	2	4	3	2	1	0	4
3	3	3	0	0	0	4			4	4	
	2	2	2	3	3	3			1	1	
		1	1	1	2	2			2	0	
F	F	F	F	F	F	F	H	H	F	F	H

There are 9 faults.

FIFO with 4 frames

3	2	1	0	3	2	4	3	2	1	0	4
3	3	3	3			4	4	4	4	0	0
	2	2	2			2	3	3	3	3	4
		1	1			1	1	2	2	2	2
			0			0	0	0	1	1	1
F	F	F	F	H	H	F	F	F	F	F	F

There are 10 faults.

Therefore we see that for more the number of frames more shall be the page faults. As we increase the page frames the chances of page repetition decreases, therefore the faults increases.

3. What is Belady's anomaly? Try the following sequence with FIFO , LRU and Optimal Page replacement algorithm

1 2 3 4 1 2 5 1 2 3 4 5

Ans:

Belady's Anomaly

Belady's anomaly is a situation where increasing the number of page frames results in an increase in the number of page faults. This is seen commonly in FIFO page replacement algorithm.

FIFO

1	2	3	4	1	2	5	1	2	3	4	5
1	1	1	4	4	4	5			5	5	
	2	2	2	1	1	1			3	3	
		3	3	3	2	2			2	4	

Optimal page

1	2	3	4	1	2	5	1	2	3	4	5
1	1	1	1			1			3	3	
	2	2	2			2			2	4	
		3	4			5			5	5	

LRU

1	2	3	4	1	2	5	1	2	3	4	5
1	1	1	4	4	4	5			3	3	3
	2	2	2	1	1	1			1	4	4
		3	3	3	2	2			2	2	5

4. Given page reference string: Compare the fault rate for LRU, FIFO and Optimal page replacement algorithm and compute which algorithm gives less fault rate.

0,2,1,6,4,0,1,0,3,1,2,1

Ans:

FIFO

0	2	1	6	4	0	1	0	3	1	2	1
0	0	0	6	6	6	1		1		1	
	2	2	2	4	4	4		3		3	
		1	1	1	0	0		0		2	
F	F	F	F	F	F	F	H	F	H	F	H

Therefore the fault rate is = $\frac{\text{Number of Faults}}{\text{Total number of frames}} \times 100\% = \frac{9}{12} \times 100\% = 75\%$

Optimal page

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

		1	1	1				1		1	
F	F	F	F	F	H	H	H	F	H	F	H

Therefore the fault rate is = $\frac{\text{Number of Faults}}{\text{Total number of frames}} \times 100\% = \frac{7}{12} \times 100\% = 58.33\%$

LRU

0	2	1	6	4	0	1	0	3	1	2	1
0	0	0	6	6	6	1		1		1	
	2	2	2	4	4	4		3		3	
		1	1	1	0	0		0		2	
F	F	F	F	F	F	F	H	F	H	F	H

Therefore the fault rate is = $\frac{\text{Number of Faults}}{\text{Total number of frames}} \times 100\% = \frac{9}{12} \times 100\% = 75\%$

Therefore the fault rate is least for **OPTIMAL PAGE**.

-----XXXX-----