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COE 1550 - Project 3 Write-Up

FIFO ANALYSIS

Trace File	Number of Frames	Number of Page Faults	Number of Writes to Disk	Belady's Anomaly Present
simple.trace	2	11	1	**YES**
	100	13	6	
swim.trace	2	81595	35382	**NO**
	100	147	35	
mcf.trace	2	3050	2099	**NO**
	100	1454	1330	
gzip.trace	2	60446	40157	**NO**
	100	40272	39757	
gcc.trace	2	127688	45107	**NO**
	100	184	436	

Table 1. FIFO Analysis

Table 1. above shows the number of page faults and writes to disk for the trace files listed in the first column. Simple.trace is the only trace in the table that shows Belady's Anomaly. Belady's Anomaly describes a situation where increasing the number of frames actually increases the number of page faults. This is shown in simple trace where 2 frames yields 11 page faults, but 100 frames results in 13 page faults.

DETERMINING OPTIMAL REFRESH PARAMETER

Trace File	Number of Frames	Refresh Rate	Number of Page Faults
gcc.trace	10	1	59292
		5	22809
		10	17996
		25	16920
		50	16611
		100	16745
		200	16809
		500	17988
		1000	18839
		5000	34879
		10000	40227
	50	1	35299
		5	15521
		10	11317
		25	5060
		50	3212
		100	1628
		200	1009
		500	613
		1000	528
		5000	470

		10000	495
	100	1	3953
		5	2655
		10	2269
		25	1734
		50	1153
		100	746
		200	625
		500	440
		1000	417
		5000	394
		10000	381

Table 2. Refresh Rates for Different Frame Numbers on gcc.trace

Table 2 above shows the page faults corresponding to refresh rates between 1 and 10000 with three different frame sizes (10, 50, and 100) for the trace file gcc.trace. In the table the minimum page fault configuration is highlighted in green. It seems that cases with larger frame numbers require a higher refresh rate to minimize page faults. The case with a frame size of 10 has a minimum number of page faults with refresh rate **50**. The case with a frame size of 50 has a minimum number of page faults with refresh rate **5,000.** Lastly, the case with a frame size of 100 has a minimum number of page faults with refresh rate **10,000**.

Because of these results, I am going to speculate that optimal refresh rate directly corresponds to the number of frames. My best estimate would be:

$$R_{Optimal} = x(N)$$

Where x is a constant value somewhere between 6 and 11 and N is the number of frames.

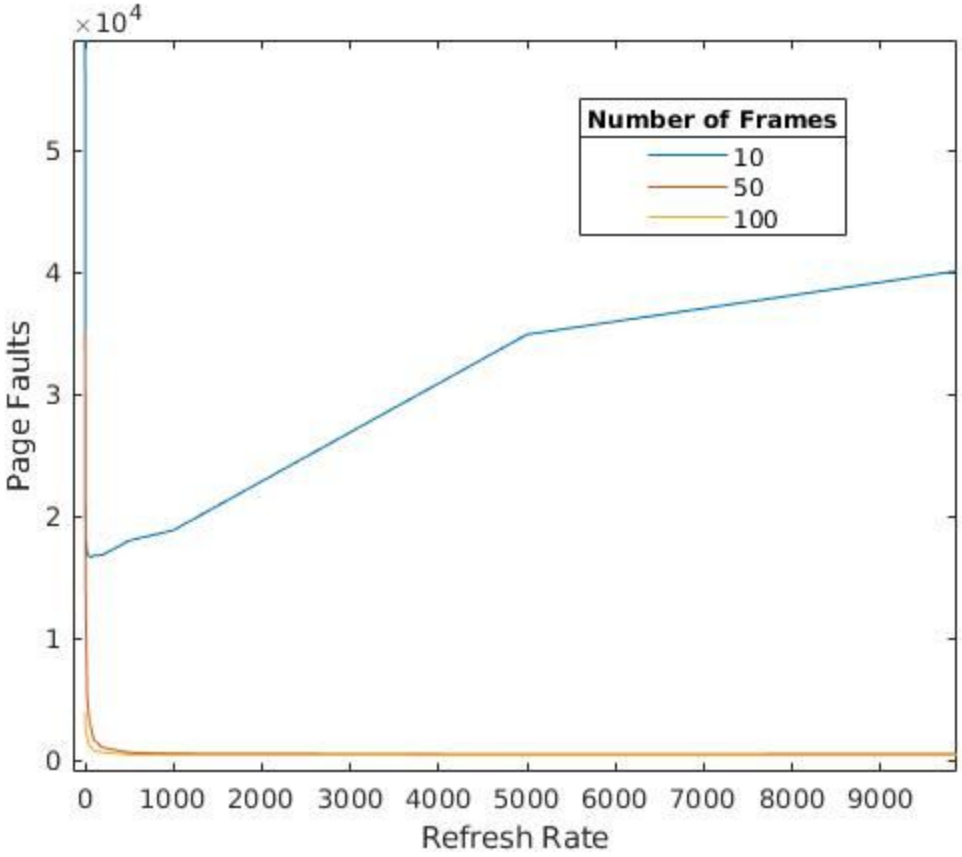

Figure 1. Optimal Refresh Rate Graph

The graph shown in Figure 1 illustrates the data found in Table 2. The figure graphs the relation of refresh rate versus page faults. The blue line corresponds to the test case of 10 frames, the red line corresponds to the test case of 50 frames, and the yellow line corresponds to the test case of 100 frames. The minimum value of each line corresponds to the optimal refresh rate.

DETERMINING THE BEST ALGORITHM

Trace File	Algorithm	Number of Frames	Page Faults	Writes to Disk
gcc.trace	Opt	10	8820	3049
	FIFO		22916	9057
	AGING (8)		18174	3670
	AGING (16)		17068	4528
	AGING (32)		17001	5060
	AGING(64)		16514	5078
	Opt	50	346	146
	FIFO		728	355
	AGING (8)		12639	1506
	AGING (16)		9213	1080
	AGING (32)		4369	618
	AGING(64)		2486	430
	Opt	100	294	102
	FIFO		436	184
	AGING (8)		2333	149
	AGING (16)		2081	149
	AGING (32)		1467	127
	AGING(64)		995	99

Table 3. Algorithm Comparison on gcc.trace

In Table 3. shown above, the three algorithms are compared with different configurations. Since Opt is going to the best, it will be used as a base for comparison. With only 10 frames, the aging algorithm with a refresh period of 64 produces the closest to optimal number of page faults, but aging with a refresh period of 8 produces the closest to optimal number of writes to disk. With 50 frames, the FIFO algorithm is the closest to optimal for both page faults and writes to disk.

With 100 frames, FIFO is the closest for the number of page faults, but aging with a refresh of 64 is the closest for writes to disk.

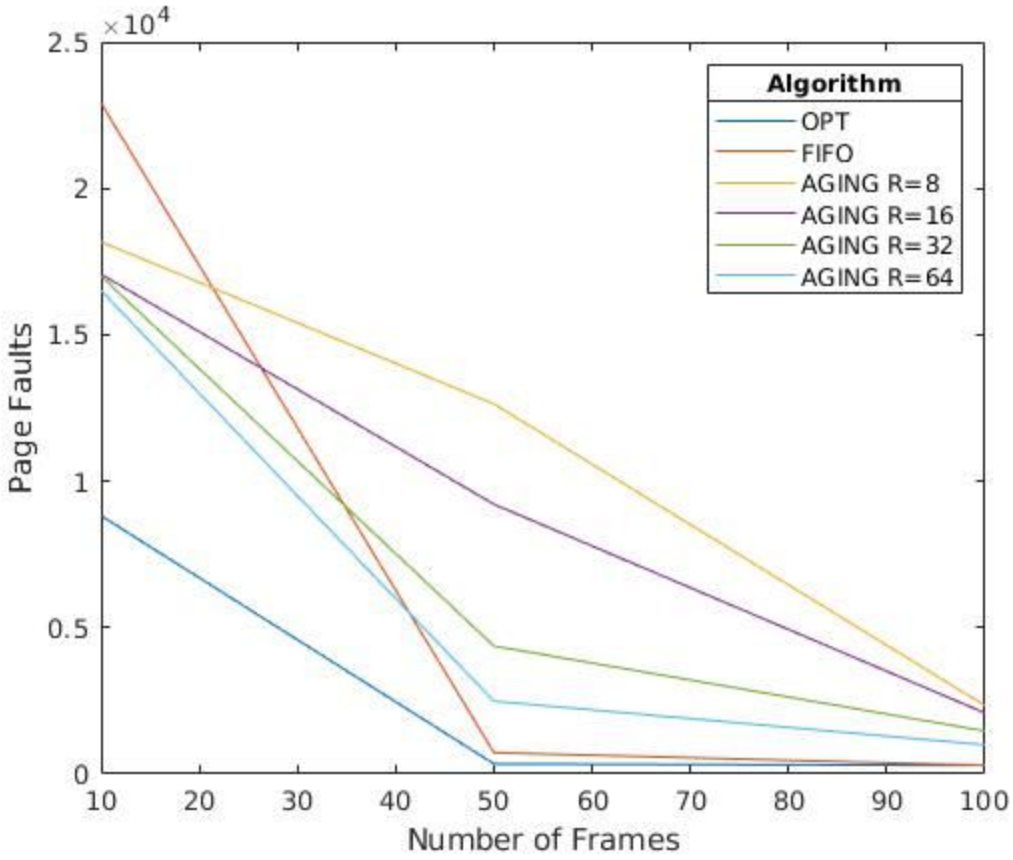

Figure 2. Page Fault Comparison by Algorithm

Figure 2 above shows a graph of page faults versus number of frames for each algorithm.

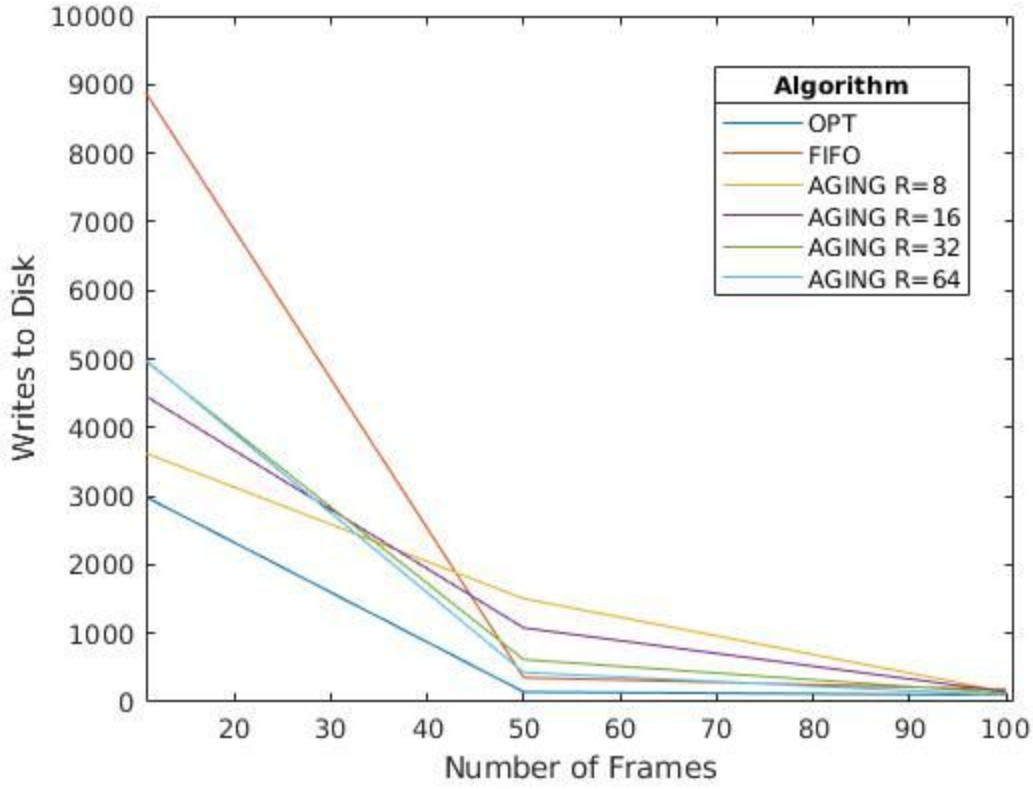

Figure 3. Writes To Disk Comparison by Algorithm

Figure 3 above shows the graph of writes to disk versus number of frames for each algorithm.