Home work of Operation System Concept (Chapter 9)

By Qiang Zheng

9.5 Cond.: 8 milliseconds for empty page available and 20 milliseconds for not empty;
Mem. Access: 100 nanoseconds;
page to be replaced is modified 70% of the time.
EAT=200ns;

Prob. : What is the maximum page-fault rate?

Ans. : Swap Page Time = (1-70%) * 8 + 70% * 20 = 16.4 milliseconds = 16400000 ns
Suppose the page-fault rate is p. We have:
EAT = (1-p) * 100ns + p * 16400000ns <= 200ns
(164000-1) * p <= 1
p <= 0.000601%
Thus, the maximum acceptable page-fault rate is 0.000601%

9.8 Cond: CPU cycle: 1microseconds, 1 additional microseconds for other page;
Page: 1000 words, paging device: 3000 revolution/min = 50revolution/sec,
transfer rate: 1million words/sec.
1% instruction access page other than current page,
80% of the instructions accessing another page are in-mem. access
50% modification of the replaced page.

Prob.: What is effective Instruction Time?

Ans. : average section time = (1 / 50) / 2 = 0.01seconds = 10,000 microseconds
page(1000 words) transfer time
= 1000 words / (1,000,000 words/sec) = 0.001 seconds = 1,000 microseconds
page fault time = page transfer time + average section time
= 11,000 microseconds
Time of swap in and swap out = 11,000 microseconds* 2
= 22,000 microseconds
Effective Instruction Time
= (1-1%) * 1 + 1% * {80% * (1 + 1) + (1-80%) * [50% * (1 + 1 + 11,000)
+ 50% * (1+ 1 + 22,000)]}
= 331.11 microseconds

9.17 Cond. Average access and transfer time of paging disk = 20 milliseconds
=20,000microseconds
Mem. access time = 1 microseconds
80% of the access are in associative memory,
10% of the the remaining cause page faults.

Prob. Effective memory access time after adding associative memory

Ans.: Effective memory access time
= 80% * 1 + (1 - 80%) [(1-10%) * 2 + 10% * (2+20,000)]
= 401.24 microseconds

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9.11 Cond. page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6,

Prob.: page faults for LRU, FIFO, Optimal in 1-7 frames respectively.

Ans :

LRU: One frame: 20 faults

Two frames: 18 faults

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

Three frames: 15 faults

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

Four frames; 10 faults

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

Five frames: 9 faults

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

Six frames: 7 faults

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

Seven frames: 7 faults

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9.11: **FIFO**: One frame: 20 faults

Two frames: 18 faults

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

Three frames: 16 faults

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

Four frames; 13 faults

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

Five frames: 10 faults

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

Six frames: 10 faults

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

Seven frames: 7 faults

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9.11. Optimal: One frame: 20 faults

Two frames: 15 faults

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

Three frames: 10 faults

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

Four frames; 8 faults

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

Five frames: 7 faults

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

Six frames: 7 faults

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

Seven frames: 7 faults