05

Assignment 4

(Q1) ~~100 x (150+120) + 30% (150)~~

Effective access time = Hit ratio x (TLB acc + Memory acc) + miss ratio x (TLB acc + (1+1) x Memory acc)

$150 = 0.7 \times (TLB + 100) + 0.3 \times (TLB + (1+1) \times 100)$

$150 = 0.7TLB + 70 + 0.3TLB + 60$

$TLB = 150 - 70 - 60$

TLB = 20ns

(Q2)

$= 0.75 \times (25 + 100) + 0.25 \times (25 + (2)(100)$

EAT = 175 ns

(Q3) $2^{22} \times 2 = 8388608$

↓ number of locations with 22 bits

8388608 MB = 8MB

Q4

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

6 5 1 2 3 6 4 2

FIFO:

f	3	3	3	4	4	4	4	4	2	2
f2		2	2	2	2	2	7	7	7	1
f3			1	1	1	1	1	6	6	6
	1	2	3	4			5	6	7	8

2	2	6	6	6	2	2	2	
1	1	1	5	5	5	3	3	
6	3	3	3	1	1	1	6	
	9	10	11	12	13	14	15	

4	4
3	2
6	6
16	17

(a) Page faults = 11

Page hits = 3

Optimal Replacement:

f_1	3	3	3	4	4	4	7	6	6
f_2		2	2	2	2	2	2	2	2
f_3			1	1	1	1	1	1	1
	1	2	3	4			5	6	

6	6		6	6	5	5	5
2	2		3	3	3	3	3
1	1		1	1	1	1	2
			7		8		9

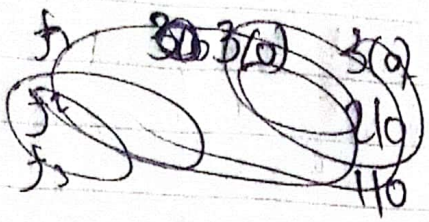
5	6	8	4	6	6		
3	3	4	3	4	4		
2	2			2	2		
	10			11			

No fault = 11

Page hit = 9

(c) Second Chance

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



f1	3|0	3|0	3|0 → 4|0	4|0	4|0	7|0
f2		2|0	2|0	2|1 → 4|1		2|0
f3		1|0	1|0	1|0	1|1 → 1|1	1|0
	1	2	3	4		5

7|0	7|0	2|0	1|0	1|1	1|1
6|0	6|0	6|0	6|0	6|0	6|0
1|0	2|0	2|0	2|1	2|1	2|0
6	7	8		9	

1|0	1|0	5|0	5|0	5|0
3|0	3|0	3|0	1|0	1|0
→ 4|0	6|0	6|0	6|0	2|0
9	10	11	12	13

3|0	3|0	3|0	2|0	17 Page f = 9
1|0	6|0	6|0	6|0	4 Page hits = 4
2|0	2|0	4|0	4|0	
14	15	16	17	

Q5 byte addressable memory, 32-bit logical address, 4KB page size, 4byte page table

[illegible] = 2^{32}

page size = 4096 B

2^{32} / 4096 = [illegible]

memory size = 2^{32} page size : 4KB = 4096 ≈ 2^{12}

$\frac{2^{32}}{2^{12}} = 2^{20}$ = 4 MB

Q6

	A	B	C	D
	alloc		alloc	
P_0	2	0	2	1
P_1	0	1	1	1
P_2	4	1	0	2
P_3	1	0	0	1
P_4	1	1	0	0
P_5	1	0	1	1

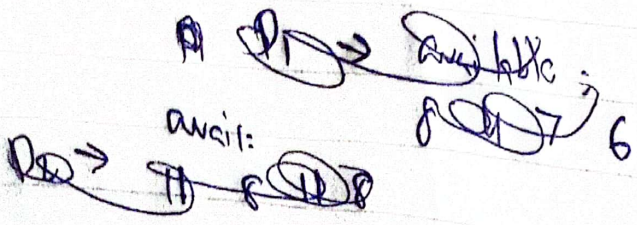
	A	B	C	D
	max			
	9	5	5	5
	2	2	3	3
	7	5	4	4
	3	3	3	2
	5	2	2	1
	4	4	4	4

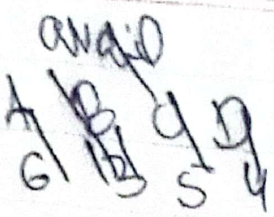
available:

A	B	C	D
6	3	5	4

Need:

	A	B	C	D	
P_0	7	5	3	4	*
P_1	2	1	2	2	✓
P_2	3	4	4	2	✓
P_3	2	3	3	1	✓
P_4	4	1	2	1	✓
P_5	3	4	3	3	✓





	A	B	C	D
after giving P_1 →	4	2	3	2
after P_1 over :	6	4	6	5

	A	B	C	D
after giving P_2 →	3	0	2	3
after P_2 over →	10	5	6	7

after giving P_3 →	8	2	3	6
after P_3 over →	11	5	6	8

after giving P_4 →	7	4	4	7
after P_4 over →	12	6	6	8

after giving P_5 →	9	2	3	5
after P_5 over →	13	6	7	9

after P_0 →	6	1	4	5
after P_0 over →	15	6	9	10

$(P_1, P_2, P_3, P_4, P_5, P_0)$