

計結 CH5

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1. (1) block size = 2^{12} (byte) = 4 (KB).

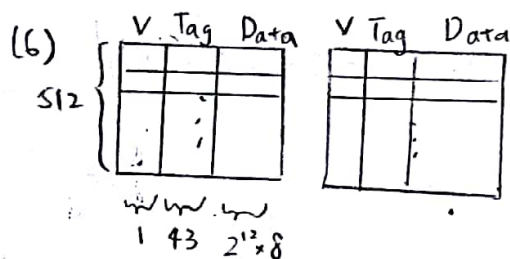
(2) # of block = $2^{10} = 1024$

(3) 4KB \times 1024 = 4096 (KB).

(4) $(2^{12} \times 8 + \underbrace{42}_{\text{valid}} + \underbrace{1+1}_{\text{dirty}}) \times \frac{1}{8} \times 1024 = 4199936$ (byte) =

(5) miss, hit, hit, miss, miss,
miss, miss, hit, hit, hit,

miss, miss, hit, miss, hit



valid bit → dirty bit

$$\left[(2^{12} \times 8 + 43 + 1 + 1) \times \frac{1}{8} \times 512 \right] \times 2$$

= 4200064 (byte).

(7) miss, hit, hit, miss, miss,

miss, hit, hit, hit, hit,

miss, hit, hit, hit, hit

2.

(1) CPI = 2 \Rightarrow IPC = $\frac{1}{2} = 0.5$

read bandwidth = $\left(\begin{aligned} &0.5 \times 3\% \times 64 \Rightarrow \text{miss in I-cache} \\ &+ 0.5 \times \frac{250}{1000} \times 2\% \times 64 \Rightarrow \text{read miss in D-cache} \\ &+ 0.5 \times \frac{100}{1000} \times 2\% \times 64 \Rightarrow \text{write miss in D-cache} \end{aligned} \right)$

= 0.32 (bytes/cycle)

(2) write bandwidth = $0.5 \times \frac{100}{1000} \times 4 = 0.2$ (bytes/cycle)

3.

(1) $1.5 + \frac{7}{100} \times 200 = 15.5$

(2) $1.5 + \frac{7}{100} \times 12 + \frac{7}{100} \times \frac{3.5}{100} \times 200 = 2.83$

(3) $1.5 + \frac{7}{100} \times 28 + \frac{7}{100} \times \frac{1.5}{100} \times 200 = 3.67$

(4) $1.5 + \frac{7}{100} \times 12 + \frac{7}{100} \times \frac{3.5}{100} \times 50 + \frac{7}{100} \times \frac{3.5}{100} \times \frac{1.3}{100} \times 200 = 2.46887$

(5) $1.5 + \frac{7}{100} \times 28 + \frac{7}{100} \times \frac{1.5}{100} \times 50 + \frac{7}{100} \times \frac{1.5}{100} \times \frac{1.3}{100} \times 200 = 3.51523$

4. LRU replacement policy

	tag	index	offset	hit/miss
0	00	00	0	miss
1	00	00	1	hit
2	00	01	0	miss
3	00	01	1	hit
4	00	10	0	miss
5	00	10	1	hit
6	00	11	0	miss
7	00	11	1	hit
4	00	10	0	hit
5	00	10	1	hit
6	00	11	0	hit
7	00	11	1	hit
8	01	00	0	miss
9	01	00	1	hit
10	01	01	0	miss
11	01	01	1	hit
16	10	00	0	miss
17	10	00	1	hit

cache

index	dirty bit	valid bit	tag	LRU	block0	block1
0	0	1	10	0	mem [16]	mem [17]
	0	1	01	1	mem [8]	mem [9]
1	0	1	00	1	mem [2]	mem [3]
	0	1	01	0	mem [10]	mem [11]
2	0	1	00	0	mem [4]	mem [5]
	0	0		1		
3	0	1	00	0	mem [6]	mem [7]
	0	0		1		

LRU 代表該 way 是否為 least-recently used，若 LRU=1，代表等一下如果這個 index 下的兩個 way 都滿了卻還有人要塞進這個 index 下，就把 LRU=1 這個 way 更新成新的值，並將此 index 下另一個 way 的 LRU 變成 1，新進來的資料 LRU=0。

5.

$$(1) (2^{19} \times 4) \times 5 = 10485760 \text{ (byte)} = 10.5 \text{ (MB)}$$

$$(2) \# \text{ of P2 needed} = \left\lceil \frac{100 \text{ MB}}{2^{24}} \right\rceil = 7$$

$$\text{size of P2 table} = (2^{11} \times 4) \times 7 = 56 \text{ (KB)}$$

$$\text{size of P1 table} = 4 \times 2^8 = 1 \text{ (KB)}$$

$$\text{total size} = (56 + 1) \times 5 = 285 \text{ (KB)}$$