CS224

Section No.: 3

Spring 2021

Lab No.: 6

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1.

No.	Cache Size KB	N way cache	Word Size in bits	Block size (no. of words)	No. of Sets	Tag Size in bits	Index Size (Set No.) in bits	Word Block Offset Size in bits	Byte Offset Size in bits	Block Replacement Policy Needed (Yes/No)
1	8	1	8	8	2^{10}	19	10	3	0	No
2	8	2	16	8	2^{8}	20	8	3	1	Yes
3	8	4	16	4	2^{8}	21	8	2	1	Yes
4	8	Full	16	4	2^{0}	29	0	2	1	Yes
9	32	1	16	2	2^{13}	17	13	1	1	No
10	32	2	16	2	2^{12}	18	12	1	1	Yes
11	32	4	8	8	2^{10}	19	10	3	0	Yes
12	32	Full	8	8	2^{0}	29	0	3	0	Yes

2.a)

Instruction	Iteration No.				
	1.	2.	3.	4.	5.
lw $t1, 0xA4($0)	Compulsory	Conflict	Conflict	Conflict	Conflict
lw $t2, 0xA8($0)	Compulsory	Hit	Hit	Hit	Hit
lw $t3, 0xAC($0)	Conflict	Conflict	Conflict	Conflict	Conflict

2.b)

For 1 set: 1 bit (from set) + 2 bits (from block offset) + 2 bits (from byte offset) = 5 bits

32 – 5 = 27 bits (for Tag), so 27 + (32 x 4) + 1 = 156 bits

Total cache memory: [1 bit (from V) + 27 bits (from Tag) + 32 x 4 bits] x 2 = 312 bits

2.c)

- 1 EQUALITY COMPARATOR (to check Tag)
- 1 AND gate (to check Hit)
- 1 4x1 MULTIPLEXER (to select word in the block)

3.a)

Instruction	Iteration No.				
	1.	**2.**	**3.**	**4.**	**5.**
lw $t1, 0xA4($0)	Compulsory	Capacity	Capacity	Capacity	Capacity
lw $t2, 0xA8($0)	Compulsory	Capacity	Capacity	Capacity	Capacity
lw $t3, 0xAC($0)	Capacity	Capacity	Capacity	Capacity	Capacity

3.b)

For 1 set: 2 bits (from byte offset) = 2 bits (No bits from set nor block offset is coming)

32 – 2 = 30 bits (for Tag). Therefore,

[1 bit (from v) + 30 bits (from Tag) + 32 bits] x 2 (for N = 2) = 126 bits (for a set & entire memory)

Total cache memory size in number of bits: 126 bits

3.c)

- 2 EQUALITY COMPARATORS (to check Tag)
- 2 AND gates (to check Hit)
- 1 OR gate (to check Hit)
- 1 2x1 MULTIPLEXER (to select way in the block)