CS224
Section No: 6
Spring 2021
Lab No: 6
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Question 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[1]	Byte Offset Size in bits[2]	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

Question 2:

a) Type Of Miss

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

b)

Cache Representation

	V	Tag	Data	Data	Data	Data
Set 1	1 bit	27 bits	32 bits	32 bits	32 bits	32 bits
Set 0	1 bit	27 bits	32 bits	32 bits	32 bits	32 bits

Cache Capacity = 8 words
Block Size = 4 words
N = 1

Block Offset = $\log_2^4$ = 2 bits
Byte Offset = $\log_2^4$ = 2 bits
Set Size = 8/4 = 2/1 = 2
Set = 1 bit
Tag = 32 – (1 + 2 + 2) = 27 bits
Total Cache Memory = (1 + 27 + 32 + 32 +32 + 32) x 2 = 312 bits

c) Required Hardware
One 4x1 Mux for selecting the word in the desired block.
One Equality Comparator for comparing the tags
One AND Gate to determine the hit

Question 3:
a) Type Of Miss

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

b)

Cache Representation

V	Tag	Data	V	Tag	Data
1 bit	30 bits	32 bits	1 bit	30 bits	32 bits

Cache Capacity = 2 words
Block Size = 1 word
N = 2
Block Offset = $\log_2^1$ = 0 bit
Byte Offset = $\log_2^4$ = 2 bits
Set Size = 2/1 = 2/2 = 1
Set = 0 bit
Tag = 32 – (2) = 30 bits
Total Cache Memory = (1 + 30 + 32) x 2 = 126 bits

c) Required Hardware
One 2x1 Mux for selecting the way in the desired block
Two Equality Comparator for comparing the tags
Two AND Gate
One OR Gate to determine the hit