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Q1) a. k = 2

addi	$t0, $0, 2	t0 = 2
sll	$t1, $t0, 2	t1 = 2
addi	$t2, $0, 9	t2 = 9 = 1001
addi	$t3, $0, 2	t3 = 2 = 0010
mult	$t2, $t3	18 = 10010
mflo	$t4	t4 = 2 = 0010
slt	$t5, $t1, $t4	t5 = 0
bne	$t5, $0, skip	
addi	$t6, $0, 1881	t6 = 1881
add	$t7, $t0, $t0	t7 = 4

Register	t0	t1	t2	t3	t4	t5	t6	t7
Value	2	2	9	2	2	0	1881	4
Points	1	3	1	1	3	3	5	3

b. imm = 12 = 0x000C

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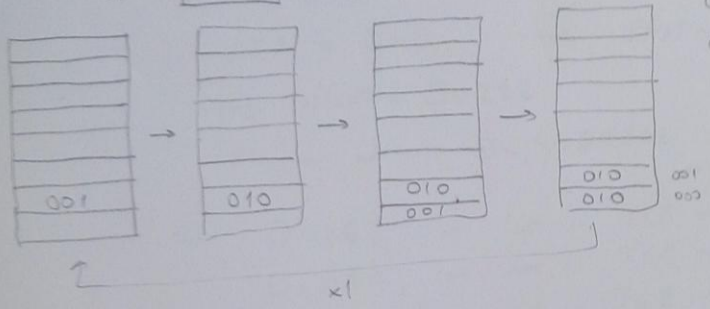
Q2) a. 8

b. %100 = 0/8



Set C

0x20 = 001 000 00

0x24 = 001 001 00

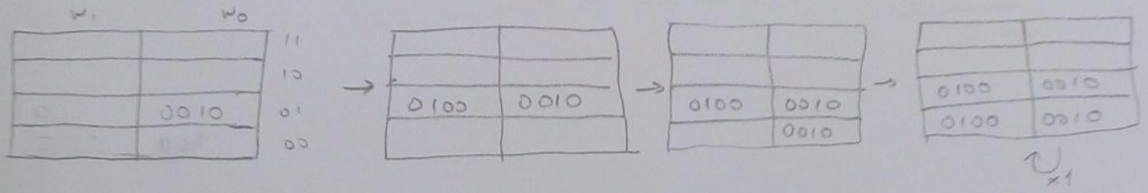
0x40 = 010 000 00

0x44 = 010 001 00

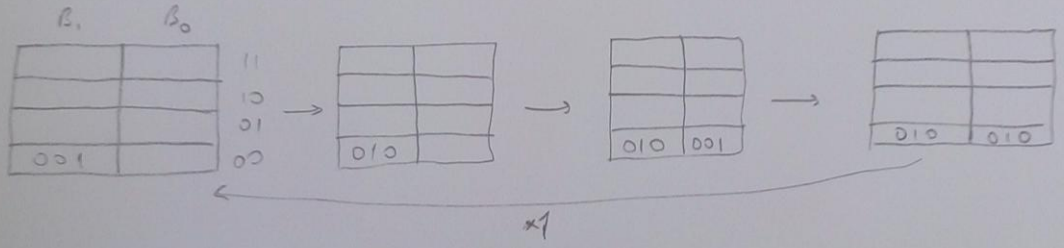
Set A, Byte offset

Set D, Block offset

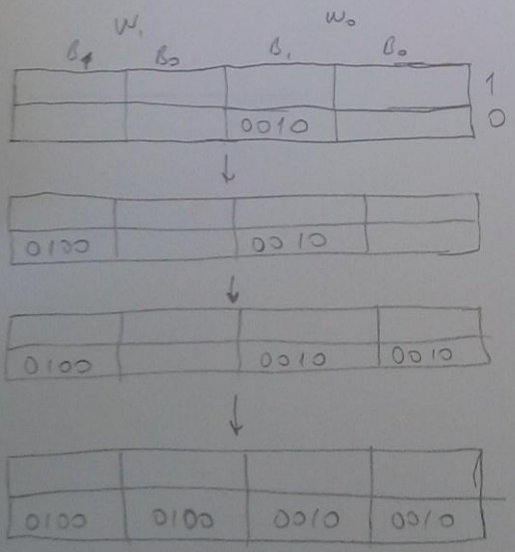
c. 4/8 = %50



d. 8/8 = %100



e.



0x20 001 0 0000

0x24 001 0 0100

0x40 01 00 0000

0x44 01 00 0100

Byte offset

Block offset

Set E

4/8 = %50

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Q3)

a. $k = 2$

$4KB = 2^{12}B$

b. 0×2222

$VPN = 0 \times 2 \longrightarrow PPN = 0 \times 40DE$

page offset = 0×222

Physical adress = $0 \times 40DE222$

c. $0 \times 042 \rightarrow$ not in TLB $\rightarrow$ look MM $\rightarrow$ 21 cc

$0 \times 082 \rightarrow$ not in TLB $\rightarrow$ look MM $\rightarrow$ 21 cc

$0 \times 0C2 \rightarrow$ not in TLB $\rightarrow$ look MM $\rightarrow$ 21 cc

$0 \times 2022 \rightarrow$ not in TLB $\rightarrow$ look MM $\rightarrow$ 21 cc

$0 \times 2022 \rightarrow$ exists in TLB $\rightarrow$ get from MM $\rightarrow$ 11 cc

$+$

95 cc

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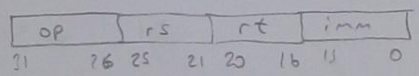
Q4) k=2

```
addi  $t1, $0, 2     t1=2
add   $t2, $t1, $t1  t2=4
and   $s4, $t2, $t2  s4=4
sub   $s5, $t2, $t3  s5=4
sw    $s1, 20($t2)
or    $s7, $t3, $t4  s7=0
```

```
IF  ID  EX  M   WB
    IF  ID  EX  M   WB
        IF  ID  EX  M   WB
            IF  ID  EX  M   WB
                IF  ID  EX  M   WB
```

sw → 

→ Instr O[20:16] = rt = $s6 = 22
= 10110

and is in Memory stage, so MemWrite M = 0

ALU Out M = $t2 and $t2 = 0010 & 0010 = 0010

Result W = $t1 + $t1 = 2+2 = 4 = 0100

Write Reg W = $t2 = 10 = 1010

Signal	Value
Instr O[20:16]	10110
Mem Write M	0
ALU Out M	0010
Result W	0100
Write Reg W	1010

Binary